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Endocrine Allergy

Clinical Reactions of Allergy to Endogenous Hormones and their Treatment*

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IN a previous paper (Zondek and Bromberg, 1945) it was reported that a state of hypersensitivity to endogenous hormones exists in certain individuals. A hypersensitive state has been observed both in respect to protein-like, e.g., insulin and pituitary secretions, and to steroid hormones. The term "endocrine allergy" covers the various manifestations of the condition of hypersensitivity to the endogenous products of the endocrine glands. Since allergy is elicited generally only by body-foreign substances, it is surprising to find that it can exist also in respect to an endogenous secretion. The following clinical and experimental findings seem, however, definitely to establish the occurrence of this condition in man.

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A. EXISTENCE OF ENDOCRINE ALLERGY.

1. Allergic hypersensivity to the steroid hormones (oestradiol, progesterone, testosterone and corticosterone[1]) or to the products of their metabolism which are excreted in the urine (oestrone, pregnandiol, androsterone) can be demonstrated in certain pathological conditions generally related to menstruation or to menopause by means of active cutaneous tests. Reactions of this type have also been observed with insulin and gonadotrophin. The positive cutaneous reaction appears in such cases 24 to 48 hours after the intracutaneous injection of oily solutions or aqueous suspensions of the allergenic steroid hormone. It persists for 24 to 48 hours or

[1] Throughout this paper desoxycorticosterone acetate was used for the detection of corticosterone sensitivity.

more. The specific character of the manifestation is reflected in the specificity of the skin reaction.

2. The positive local reaction originally elicited by an intracutaneous injection of a steroid hormone can recur at its first site when the allergen is injected subcutaneously at a second site. This phenomenon, called by us the "recurrent reaction", shows that the injection hormone is an authentic allergen.

3. Some patients, in whom the symptoms of allergy recur in the premenstruum, may show a recurrent positive cutaneous reaction in the same phase in several successive menstrual cycles. It seems significant that this "retarded cutaneous reaction" recurs at a time point which coincides with the attainment of peak hormone concentrations in the body. This circumstance further strengthens the proof of the existence of endocrine allergy.

4. Allergic patients not previously treated with hormones can sometimes react to an injection of even minimal amounts of a steroid hormone with serious general symptoms of an allergic nature, such as asthma, urticaria, angioneurotic oedema, fever, etc.

5. In one case, a severe attack of pruritus vulvae has been observed following the ingestion of 50 g. of glucose by a patient in climacterium suffering from pruritus vulvae. Diabetes was not present in this patient. On the contrary, her blood analysis and a sugar tolerance test revealed hypoglycaemia due to hyperinsulinism. Following an intradermal injection of a minimal dose of insulin (0.0002 I.U.) a typical positive cutaneous reaction to this hormone was obtained. Local as well as general methods of treatment (including hormones: oestrogenic hormones and testosterone) failed to give relief. Desensitization treatment with insulin procured relief.

6. The presence of reagins to a hormone can be demonstrated in certain cases by means of passive transfer tests with serum taken from women hypersensitive to endogenous sex hormones and injected intracutaneously into normal women, followed by injection of the allergen at the same place (Prausnitz-Kuestner test).

7. Serum from patients sensitive to oestrone or oestradiol elicited in normal women a positive cutaneous test ("endogenous passive transfer test") when it was injected during their premenstrual phase. This fact shows that skin reactions which become positive when the allergic hormone in the body reaches its peak value can be elicited by serum reagins.

8. The properties of the hormone reagins resemble those of ordinary reagins (Zondek and Bromberg, 1945).

9. Allergic constitutional or hereditary predispositions are often disclosed by the personal and familial histories of patients with a positive cutaneous reaction to a hormone.

10. Often desensitization with an allergenic hormone brings complete relief. The results obtained suggest that the desensitization treatment is specific.

The view has been put forward that migraine in women with allergic tendencies may be due to the fact that they have an exaggerated susceptibility to pituitary gonadotrophin (Glass, 1936). Geber (1939) and Urbach (1939) found that serum taken from patients during an attack of premenstrual dermatitis is able to elicit severe skin reactions when it is injected into the skin of the same patients. Allergic hypersensitivity to insulin has been demonstrated in skin tests with injections of crystalline animal insulin and human insulin (Lowell, 1942) and also in positive transfer tests (Prausnitz-Kuestner test) with serum containing reagins to insulin (Tufts, 1928).

Allergy to progesterone has been assumed in cases of hyperemesis of pregnancy (Finch, 1938).[2]

The positive intracutaneous test to steroid hormones was found to be relatively frequent in cases of complaints connected with menstruation or menopause. It was this observation which led us to suspect the existence of sensitivity to endogenous hormones in cases of this type. Patients suffering from manifestations of an allergic nature, such as asthma, vasomotor rhinitis, angioneurotic oedema, urticaria, migraine, and certain forms of eczema related to menstruation or menopause, often gave positive skin reactions to different steroid hormones. Hypersensitivity to hormones was also found in patients with manifestations strictly linked to menstruation or menopause, e.g., premenstrual tension, premenstrual fever, vomiting or nausea, pruritis vulvae and certain ocular disturbances (superficial keratitis and chronic recurrent conjunctivitis).

The present communication deals with certain clinical features of the condition of endocrine allergy and describes the methods which we employ in this condition in order to bring about desensitization.

Our material: 216 women were tested[3] in regard to sensitivity to hormones. Of them 32 were in good health and had regular periods, 68 suffered from disturbances not connected with the genital function, and 116 had complaints related to menstruation or menopause. A positive skin reaction to hormones was never observed in healthy women. Only 2 of the 68 cases (3.3 per cent) with complaints not related to menstruation or menopause showed positive responses. In patients with complaints related to menstruation or menopause, a positive cutaneous test to a hormonal allergen was found in 73 cases (63 per cent) (Table I). Endocrine allergy tests were only undertaken after trials of ordinary exogenous allergens and miscellaneous trials of different routine methods of treatment proved unsuccessful. The majority of 73 patients who proved sensitive to an endogenous hormone have a familial or personal history of allergy and the blood picture showed marked eosinophilia. In several cases specific desensitization was carried out. The cases which showed a positive cutaneous test had the following complaints:

(a) In relation to menstruation: 2 asthma, 2 vasomotor-rhinitis, 3 angioneurotic oedema, 4 urticaria, 1 eczema, 4 acne, 6 migraine, 3 superficial keratitis, 22 premenstrual tension, 3 premenstrual fever, 10 pruritus vulvae.

(b) In relation to menopause: 1 asthma, 1 urticaria, 1 eczema, 3 migraine, 5 pruritus vulvae.

The observed cases, as has already been mentioned, had one feature in common: the complaints related to menstruation or menopause. This leads us to consider that hormones or their derivatives in certain cases sensitize the organism only when their concentrations in the body tissues are at the peak level, e.g., towards the termination of the menstrual cycle or at the beginning of the menopause (first hyperhormonal phase) (Zondek, 1931; 1935*a*).

Steroid hormones (oestrone, oestradiol, progesterone, pregnandiol, testosterone, androsterone and corticosterone) as well as prolan (chorionic gonadotrophin) and insulin have been found capable of allergenic activity. The clinical manifestation of endocrine allergy can be the same although the hormonal allergen which is operative in different cases may vary.

[2] In a series of 12 women suffering from vomiting of pregnancy we were unable to find positive skin reaction to steroid hormones.

[3] In our previous paper (Zondek and Bromberg, 1945) we reported 165 cases. In the meantime 51 additional women were tested.

TABLE I.

Distribution of Cases Tested for Endocrine Allergic Condition.

Diseases investigated		Related to menstruation			Related to menopause		
		Number of cases tested	No. of hormone sensitive cases	Hormonal allergen	Number of cases tested	No. of hormone sensitive cases	Hormonal allergen
Respiratory system	Asthma	2	2	1 oestrone 1 corticosterone*	3	1	Oestrone
	Vasomotor-rhinitis	2	2	1 oestradiol 1 testosterone	–	–	
Cutaneous system	Angioneurotic oedema	6	3	1 progesterone 2 testosterone	–	–	
	Chronic urticaria	8	4	2 oestrone 1 progesterone 1 testosterone	3	1	Corticosterone*
	Chronic eczema	4	1	oestradiol	2	1	Testosterone
	Acne	10	4	3 oestrone 1 corticosterone*	–	–	
Nervous system	Migraine	11	8	2 oestradiol 2 oestrone 1 progesterone 1 pregnandiol 1 androsterone 1 corticosterone*	6	3	1 oestrone 1 testosterone 1 prolan
Ocular system	Superficial keratitis	3	3	2 corticosterone* 1 androsterone	–	–	
Genital system	Premenstrual tension	33	22	4 oestradiol 7 oestrone 1 progesterone 5 testosterone 1 androsterone 4 corticosterone*			
Genital system	Pruritus vulvae	13	10	1 oestradiol 4 oestrone 2 progesterone 1 corticosterone* 2 testosterone	7	5	2 oestrone 1 prolan 2 insulin
	Premenstrual fever	3	3	1 oestrone 2 testosterone	–	–	

* Desoxycorticosterone acetate served as test substance.

B. DIAGNOSIS OF ENDOCRINE ALLERGY BY CUTANEOUS TESTS WITH HORMONES.

Allergenic Hormones. The methods used to detect allergenic hormones have been presented in an earlier paper (Zondek and Bromberg, 1945). The following hormones and their metabolites of the genital and adrenal glands were tested: 1, oestradiol; 2, oestrone; 3, progesterone; 4, pregnandiol; 5, testosterone; 6, androsterone; 7, desoxycorticosterone acetate. Solutions of the steroids were prepared in oil in concentrations of 0.1 mg. per 0.1 ml. pure olive oil. Recrystallized steroid hormones were used. The olive oil was first purified

according to the Pharmacopeia Helvetica VI, and heated at 100°C for 48 hours. The hormone crystals were dissolved in this oil at 100°C. by heating for another 24 hours. In this way sterile, clear, homogeneous solutions must be obtained. Control tests were performed on the oil vehicle and on cholesterol alone. The hormone and the control solutions were applied intradermally with a small needle. Originally the dose employed amounted to 0.1 ml. containing 0.1 mg. of the crystalline hormone. The injections were made on the outer border line between the volar and dorsal surfaces of the arm and forearm. This site is preferable to the more commonly used volar surface, the skin on the latter being too thin for an injection of oil. In order to avoid immediate non-specific oil reactions, the needle should be inserted through the epidermis into a layer somewhat deeper than that usually employed in tests of aqueous solutions.[4] To avoid contamination, a separate syringe and needle is used for each test. The skin reaction was read 24, 48 and 72 hours after the injection. A reaction was considered positive when 24, 48 or 72 hours after injection a red or rose-coloured, slightly elevated papule, at least 0.5 cm. in diameter, appeared at the site of injection. The reaction was also considered positive when 24 or 48 hours after the injection a pink erythema, 2–3 cm. in diameter, appeared at the site of the injection. Positive reactions persist generally for 48 hours, but sometimes remain as a rosy, itching erythema for many weeks. When the 24 hours' reaction is of an inconclusive nature, a second reading can be taken at 48 hours. Specific positive reactions persist usually for 48 hours and sometimes for 72 hours.

Cases in which an intracutaneous injection of 0.1 mg. of steroid hormone produced an unusually severe local reaction were tested in respect to graded dilutions of the allergen. In some instances 0.001 mg. (1 gamma) sufficed to bring about a local reaction.[5]

In certain cases a positive reaction appeared 3–5 hours after the injection and disappeared some hours later. Such results were read as doubtful, since prolonged contact between an allergen and a tissue is a characteristic of a true allergy reaction. In doubtful cases the following test was also performed: 24 hours after an intracutaneous injection of 0.1 mg. of the test hormone, 1 mg. of the latter was injected subcutaneously at a new site. The patient was reported as sensitive if 3–5 hours after the second injection a slight reddening accompanied by itching appeared at the site of the first, the intradermal, injection ("recurrent test reaction"). Since reactions are usually read 48 or 72 hours as well as 24 hours after the injection, we employ the recurrent test reaction now only in exceptional cases.

In rare cases reactions became positive shortly before a menstrual flow, 2–3 weeks after an injection. Reactions of this kind were reported as positive ("retarded reaction"). In some cases positive cutaneous reactions recurred spontaneously in the premenstrual period of several successive cycles ("periodic retarded reaction"). In one case of migraine with sensitivity to oestrone, the positive skin reaction recurred in every one of 8 subsequent premenstrual periods, after which, pregnancy interven-

[4] Consequently there does not appear a wheel at the site of injection but a slight elevation of the epidermis. We have learned that this point is of decisive importance, otherwise non-specific reactions may occur.

[5] In recent months, we employed for the tests a solution of 0.01 mg. hormone in 0.1 ml. oil. This amount elicits a positive skin reaction in a majority of allergy cases. It is possible, however, that it fails to elicit a positive reaction in a certain percentage of them. Our experience on this point remains at present inadequate for any definite conclusion.

ing, both the positive skin reaction and the clinical complaints disappeared.

Sensitivity to oil (7.5 per cent) or cholesterol (1.9 per cent) alone was observed in 9.4 per cent of the cases. These were excluded from further investigations. When sterile solutions are used, the intracutaneous injections never evoke an inflammatory reaction. Questions which colleagues have addressed to us lead us to believe that certain points in our earlier description (Zondek and Bromberg, 1945) of the technique have been misunderstood. Errors have arisen in consequence. The quality of the oil vehicle is a very important point. We use olive oil made from Palestinian olives, and purified as prescribed in the Pharmacopeia Helvetica. The hormone preparations should be of the highest purity and recrystallized. Contaminants can frequently elicit non-specific reactions. To check this possibility we first test our preparations on healthy subjects. Normal individuals should give no positive skin reactions to hormonal allergens.

For the cutaneous test of gonadotrophin (korotrin) or insulin, aqueous solutions were used. Such tests were read as positive when a large erythema with urticarial oedema and itching appeared at the site of the injection 1–2 hours after the inoculation. The insulin was in a dilution of 1:10,000 (0.1 ml. = 0.0002 I.U.) and the korotrin (prolan) was dissolved in normal saline (1 ml. = 1 I.U.); control tests for prolan were run on the same solution after inactivation of the gonadotrophin by boiling.

Principles of Cutaneous Testing with Steroid Hormones.

As has been shown above, the clinical diagnosis of endocrine allergy is essentially based on the positive cutaneous tests for hormonal substances. Since the specifity of the positive reactions is greatly dependent (as in other allergic tests) on accurate technique, the principles of cutaneous testing with steroid hormones will again be summarily reported.

Materials: (1) Olive oil (purest quality available) purified according to Pharm. Helvet. VI, and heated at 100°C for 48 hours.

(2) Recrystallized steroid hormones (oestradiol, oestrone, progesterone, pregnandiol, testosterone, androsterone, desoxycorticosterone acetate).

(3) Cholesterol.

(4) Nine syringes 1 ml. (preferably tuberculin syringes).

(5) Fine needles for intracutaneous testing.

Preparation of Test Solutions. The hormones as well as cholesterol are dissolved in oil by heating at 100°C. for another 24 hours until a sterile, clear, and homogenous solution is obtained. All the substances are used in concentrations of 1 mg. in 1 ml. of oil.

Site of injection. Outer border line between the volar and dorsal surfaces of the arm and forearm. Injections must be given into a skin layer deeper than that into which aqueous solutions are injected.

The positive reaction (readings: 24, 48 and 72 hours after the injection). Red or rose-coloured slightly elevated papule at least 0.5 cm. in diameter, or pink erythema 2–3 cm. in diameter.

All other reactions reported above ("recurrent reaction", "retarded reaction" and "periodic retarded reaction") were employed only as contributory methods serving to confirm the allergy to endogenous steroid hormones and not as usual tests for diagnosis of endocrine allergy.

The significance of positive cutaneous reactions for hormones.

The positive skin reactions to steroid hormones are of "delayed" type, since

they commonly appear or reach their maximum intensity 24 hours after injection. On the other hand, the water-soluble hormones yield reactions of "immediate" type, appearing in 1–2 hours after injection. It has been assumed that both reactions result from the same immunological process (Dienes, 1931: Simon and Rackemann, 1934: Jones and Mote, 1934).

It has also been assumed that "delayed" skin reactions appear only when the body has been exposed to the action of the allergen for a long period of time (Vaughan, 1929), which is also generally the case in endocrine allergy, or that they indicate the formation not of circulating, but of cellular antibodies (Urbach, 1943).

C. Clinical Observations.

With few exceptions, the existence of a condition of allergy to endogenous hormones deserves consideration in cases of disorders connected with menstruation or menopause. In certain conditions, endocrine secretions which are harmless to the great majority of normal individuals may elicit in different organs allergic reactions, such as asthma in the bronchial system, or urticaria on the skin. A particular organ can also react with the same allergic symptoms to different hormones. Urticaria, for example, can be the result equally of a state of hypersensitivity to either oestrone, testosterone or progesterone.

Endocrine allergy can frequently play a role in gynaecological conditions which are associated with the premenstrual phase, e.g. hypogastric pains, migraine, vomiting, and fever. Pruritus vulvae related to menstruation or menopause is often due to endocrine allergy.

In the following, the allergic reactions to endogenous hormones are classified according to the organ affected. The case reports will include both an account of the symptoms and a brief mention of the results obtained in desensitization.

D. Endocrine Allergic Reactions of the Different Systems.

Respiratory System.

(*a*) *Asthma related to menstruation or menopause.*

In some women with asthma there is evidence of a relationship between the clinical course of the disease and genital function. The onset of asthma is frequently associated with the first menstruation at puberty. The attacks, moreover, often recur at a given point in the menstrual cycle; generally they are experienced in the premenstrual period when the steroid hormones reach peak values in the body. Often pregnancy brings improvement or relief from the asthmatic attacks. Often onset of asthma occurs during the hyperhormonal early phase of the menopause. It has been mentioned that certain cases of asthma may be due to the presence of a hypersensitivity to oestrogenic hormone (Urbach, 1943).

Five cases of asthma were studied. In 2 the attacks always recurred before menstruation. In 3 cases asthma related to onset of menopause. Both of the 2 premenstrual cases exhibited hormone sensitivity, 1 to oestrone and the other to corticosterone. Desensitizing treatment was followed in the oestrone-sensitive case by recovery and in the corticosterone-sensitive woman by improvement. Only 1 of the 3 menopausal cases exhibited hormone sensitivity. In this case, one of oestrone-sensitivity, desensitization produced marked but transient relief. Two cases of asthma are reported fully below.

Case 1. Mrs. R.M. 33 years old. According to the family history, patient's mother complained of asthma, and 2 of her brothers suffered from hayfever. Eosinophilia, 3 per cent. Slight lymphocytosis, 38 per cent. For about 5 years asthmatic fits had recurred regularly in the 10 days preceding menstruation. In the last pregnancy, 2 years before,

the complaints disappeared during the second half of the pregnancy, after some aggravation during the first months. A cutaneous hormone test, performed after menstruation, revealed the existence of a sensitivity to oestrone. Twenty-four hours after the test, for the first time after a menstruation, a serious asthmatic attack occurred. Desensitization treatment with gradually increasing daily doses of oestrone (from 0.001 mg. to 1 mg.), administered subcutaneously in a series of 30 injections, was undertaken. In an observation period of 5 months following the treatment, the patient was free from asthmatic attacks. At the end of this time the patient stopped coming for observation.

Case 2. Mrs. H.P. 52 years old. Suffered in the last 2 years from frequent and severe attacks of asthma. Tests for external allergens gave negative results. The asthmatic fits in the form of severe daily attacks began simultaneously with the menopause. Hormone tests revealed sensitivity to oestrone. Treatment with subcutaneous injections of gradually increasing doses of oestrone was instituted. After the injections, the patient remained free from asthmatic attacks for 3 months, after which an asthmatic attack occurred. The patient then received a second series of oestrone injections, and for 2 months no attacks occurred. After a third course of treatment, no asthmatic attack was reported during a follow-up period of 1 year.

(*b*) *Vasomotor rhinitis in the premenstrual period.*

Vasomotor rhinitis, characterized by paroxysmal attacks of sneezing accompanied by nasal obstruction or serous rhinorrhoea, is generally due to exogenous, chemical or bacterial allergens. However, in some instances, the relationship between the clinical picture and the hormonal cycle suggests that female sex hormones are the allergenic substances. Some women have the attacks periodically in connexion with menstruation; moreover, pregnancy sometimes improves the rhinitis.

Selected cases with hypersensitivity to hormones—one to oestradiol, and the other to testosterone—were studied. Specific desensitization proved successful in both cases. In the same context a case reported by Riebel (1935), in which attacks of premenstrual rhinitis were related to hypersensitivity to oestrone, should be cited. The case with vasomotor rhinitis due to hypersensitivity to oestradiol is reported below.

Case 3. Mrs. P.M. Age 37. Had been suffering from attacks of vasomotor rhinitis for the last 3 years.[6] All tests of external allergens were negative in result. Paroxysms of rhinitis always occurred in patient during the week preceding menstruation. Paroxysms were characterized by violent sneezing accompanied by an irritating mucous discharge and severe photophobia. During the same period, patient also suffered from urticaria, headaches and heavy spasmodic pains in the lower abdomen. Onset of menstrual flow always produced complete relief from all these symptoms. The family history revealed asthma in patient's mother and sister. Blood eosinophilia, 7 per cent. Cutaneous hormone tests revealed a sensitivity to oestradiol. Desensitization treatment was performed by subcutaneous injection of oestradiol in increasing doses. Following this treatment, 8 premenstrual periods passed without pathological symptoms. Slight rhinitis before the ninth menstruation was treated by desensitization to oestradiol. During the 6 months which have since elapsed, the symptoms have not recurred.

Endocrine Allergic Reactions of the Cutaneous System.

(*a*) *Angioneurotic oedema.* Although angioneurotic oedema is not always conditioned by allergic sensitization, there are numerous cases of this disease which have definitely been proved to be of allergic origin. Sudden attacks of pale, circumscribed swellings on various parts of the body occasionally occur in relation to the menstrual cycle and may be due to endocrine allergy.

Of 6 cases of angioneurotic oedema related to menstruation, 3 showed positive cutaneous tests to hormones, 1 of them to

[6] We are indebted to Dr. Lachman, head of the Otolaryngological Department, for this case.

progesterone and 2 to testosterone. In all 3 positive cases, oedema of the face and of the skin of the hands and swelling of the mucous membrane of the lips and tongue were observed. The manifestations appeared 2–5 days before menstruation and persisted till the onset of the flow. In 1 case very severe headache and slight urticaria accompanied the symptoms. The 2 cases in which testosterone sensitivity had been detected were treated successfully by desensitization.

CASE 4. Mrs. C.R. Age 28. Married and mother of 2 children. In the last 4 years the patient had complained of paroxysmal swellings of the face, lips and tongue. The symptoms appeared regularly 2 days before menstruation and subsided following the onset of menstrual bleeding. Suffered also from severe headaches and slight urticaria. No contributory information was found in the family history. Blood picture: normal. Hormonal tests showed sensitivity to testosterone. Urticaria and slight oedema of lips developed following the performance of the tests. Desensitization with gradually increasing doses of testosterone was undertaken. Following treatment, the patient remained free from the mentioned disturbances for 2 premenstrual periods. The patient came back to us in her third premenstrual period with an attack of facial oedema and dyspnoea due to laryngeal oedema. The desensitization treatment was repeated and in its termination a 10 mg. pellet of testosterone was implanted. In the following 8 months no recurrences of angioneurotic oedema were observed. After this period the patient stopped coming for examination.

(*b*) *Chronic urticaria.* The variety of the aetiological factors and the short duration of urticaria render particularly complicated the study of its pathogenesis and therapeutic possibilities. All the cases examined by us involved complaints which had lasted for at least one year. Earlier attempts at treatment and investigations of the aetiology of the condition had been negative.

Eight cases of urticaria with exacerbation before and during menstruation were tested for hormonal sensitivity. Four of the cases proved to be sensitive to various hormones (2 to oestrone, 1 to testosterone, and 1 to progesterone). One of 3 cases of urticaria occurring at the onset of menopause showed a positive hormone cutaneous test (corticosterone). Desensitization treatment in the 2 oestrone-sensitive cases, in the progesterone-sensitive and in the corticosterone-sensitive cases gave satisfactory results. Recovery in the oestrone and in the corticosterone cases and improvement in the 2 other cases were reported.

CASE 5. Miss L.O. 25 years old. Regular menstruation. In the last 2 years the patient complained of attacks of urticaria occurring in the second half of the menstrual cycle. At onset of menstruation complete relief was always obtained. Search for an external or dietary allergic substance yielded negative results. Family and personal history without special findings. Blood eosinophilia, 6 per cent. The hormonal cutaneous tests revealed a sensitivity to oestrone. Specific desentization produced complete relief from the urticaria. The patient received 30 injections over a period of 1 month, the initial dose of 0.01 mg. being increased stepwise to 1 mg. per injection. Three years after treatment, the patient was still free from any of the symptoms.

(*c*) *Chronic eczema.* Endocrine allergy is very rarely a causative factor in chronic eczema. A relationship between hormonal metabolism and the clinical course of eczema may, however, occasionally be observed. In certain cases, eczema recurs at each menstrual period and disappears during pregnancy or at the menopause; in other cases the complaints seem to be related to the beginning of menopause. Hormonal hypersensitivity was found to exist in 1 of 4 cases of chronic eczema related to menstruation and in 1 of 2 cases of eczema related to menopause. The case in which the aggravation of the symptoms recurred at menstruation showed oestradiol sensitivity; that with symptoms in the menopause showed testosterone sensitivity.

Desensitization was carried out only in the last case, and without result.

(*d*) *Acne*. Ten cases of acne, with exacerbations 1 or 2 weeks preceding menstruation, were studied for hormonal sensitivity. Four cases showed a positive cutaneous test, 3 to oestrone and 1 to corticosterone. Desensitization treatment was practised in 3 cases with the following results: marked improvement of 1 oestrone-sensitive and of 1 corticosterone-sensitive case; no significant effect in 1 oestrone-sensitive case.

CASE 6. Mrs. R.Y. Aged 19. Suffers from severe facial or thoracic acne which is aggravated before each menstruation. Intracutaneous tests with hormones revealed sensitivity to oestrone. Cutaneous reaction remained positive after the inoculation for 10 days. Desensitization was *via* 2 routes: the percutaneous and the subcutaneous. For 3 weeks the patient received oestrone in doses of 1 mg. in lanolin by daily inunctions of the affected skin site and in increasing doses from 0.01 to 1 mg. by subcutaneous injection. Improvement followed this treatment, which was further extended by the implantation of 25 mg. of oestrone in the form of a pellet. There was still no relapse of the facial or thoracic acne 6 months after the treatment, when the patient was last seen.

ENDOCRINE ALLERGIC REACTIONS OF THE NERVOUS SYSTEM.

Various neurologic and psychic disturbances become aggravated during the menstrual period or at menopause. Manifestations attributed to diseases of the central nervous system (migraine, epilepsy) as well as to peripheral nerves (certain forms of neuralgia) may appear, become aggravated, or recur in relation to the genital function. Three cases of epilepsy[7] with fits coming on shortly before menstruation, 2 cases of premenstrual sciatica, 1 case of climacteric arthralgia of the knee, and 5 cases of premenstrual depressions, gave negative skin tests to hormones. On the other hand, migraine related to menstruation or menopause was found to be of endocrine allergic origin in a considerable percentage of cases.

Migraine. Attacks of migraine in women are often connected with the sexual cycle. The frequent onset of pains shortly before menstruation or at the beginning of the menopause and their relief or improvement during pregnancy suggest that there is a relationship between this syndrome and the endocrine secretions. Eight out of 11 cases of migraine related to menstruation showed sensitivity to hormones (2 to oestrone, 2 to oestradiol, 1 to progesterone, 1 to pregnandiol, 1 to androsterone, and 1 to corticosterone). In 6 other menopause cases, 3 had positive cutaneous tests, 1 to testosterone, 1 to oestrone, and 1 to prolan. Treatment was given in 8 cases, of which 6 showed either recovery or improvement.

CASE 7. Mrs. T.L. Aged 34. Married and mother of a 3-year-old child. Had been suffering for 7 years regularly on the 14th and 28th days of the cycle from migraine, which prevented her from pursuing her usual occupation. No organic cause was disclosed by various examinations. The blood picture showed high eosinophilia (12 per cent) and 40 per cent lymphocytosis. During her one pregnancy the patient had been completely free from headache. In the family records allergic diseases (asthma, urticaria, and hay-fever) were frequent. The cutaneous hormone tests disclosed a sensitivity to oestradiol. A positive intracutaneous test was elicited not only by the usual dosage of 0.1 mg. but even by as little as 0.001 mg. of oestradiol. Of interest is the fact that the local test, once induced, recurred spontaneously in the premenstrual phase of seven successive menstrual periods ("periodic retarded reaction"). 0.1 ml. of the serum of this patient, taken during an attack, was injected intracutaneously into the skin of a normal individual. The latter showed after 24 hours a positive skin reaction when 0.1 ml. of an aqueous solution of oestradiol (100 I.U.,

[7] Several cases of epilepsy occurring during the premenstruum have been treated by the senior author with different hormones without success.

1 ml.) was injected in the skin at the same site (Prausnitz-Kuestner test). Positive skin reactions were also elicited by injection of the serum into normal women during the premenstrual phase ("endogenous passive transfer test") (Zondek and Bromberg, 1945). Specific densensitization with increasing doses of oestradiol (initial dose 0.001 mg.) given in subcutaneous injections brought relief from this severe disturbance. The patient when last seen, 1 year after treatment, reported a complete cure.

CASE 8. Mrs. S.T. Aged 52. Three years in menopause. Had suffered from severe migraine accompanied by lingual neuralgia since the onset of menopause. Frequent flushes and sensation of peculiar odours and tastes. For a year the patient had been treated with vitamins, hormones and by physiotherapy without success. Hormone cutaneous tests revealed a sensitivity to prolan. Treatment consisted in high doses of testosterone (200 mg.), given with a view to eliminating the allergen (gonadotrophin) through inhibition of the secretion of gonadotrophin by the hypophysis. Following this treatment, the complaints disappeared.

ENDOCRINE ALLERGIC REACTIONS OF THE GENITAL SYSTEM.

Allergy to exogenous allergens should be considered as a possible fact or in the aetiology of such disorders of the genital organs as pruritus vulvae, eczema, leucorrhoea (Rowe, 1928) and dysmenorrhoea (Smith, 1931). Several cases with disorders of the genital function were examined as to hormonal hypersensitivity by the skin test method. Eleven cases of dysmenorrhoea, 5 of amenorrhoea and 7 of menometrorrhagia exhibited negative tests. In premenstrual tension and pruritus vulvae related to menstruation or menopause, on the other hand, positive results were frequent.

(*a*) *Premenstrual tension.* This group of disorders deserves detailed consideration as it offers a high percentage of positive tests and many cases in which promising results were obtained with desensitization. Premenstrual tension consists of pains in the lower abdomen and back, accompanied often by nervous irritability, depression, severe headache, vomiting and nausea, and less frequently by pains in the breasts and diarrhoea. The symptoms generally begin 1 week prior to, and disappear at the onset of the menstrual flow. The condition should be distinguished from essential dysmenorrhoea which is characterized by cramp-like severe pains in the lower abdomen during the flow. Menstrual dysmenorrhoea is usually conditioned by mechanical, inflammatory, neuralgic or other such factors. The hormone cutaneous tests were negative in a series of such cases (Zondek and Bromberg, 1945).

Out of 33 cases of severe premenstrual tension, 22 showed positive cutaneous reactions to a hormone. In 6 of the positive cases vomiting and nausea accompanied the abdominal pains. Two cases complained of diarrhoea, 2 of pains of the breasts and 12 had pains in the abdomen and back only. The following hormones were found in these cases to act as allergens: oestrone 7 cases, oestradiol 4, progesterone 1, testosterone 5, androsterone 1, and corticosterone 4 cases. Desensitization which was performed in 12 cases gave complete relief in 7, improvement in 2, and no improvement in 3 cases.

CASE 9. Mrs. S.S. Aged 26. Married, never pregnant. Had been suffering for 8 years from premenstrual severe pains in the lower abdomen and from abundant vomiting lasting for 7 days. Six months before, the premenstrual attack had been so severe as to raise the suspicion of acute appendicitis. A subsequent appendicectomy brought no relief. Eosinophilia 9 per cent. Suffered periodically from urticaria. Cutaneous tests revealed a positive response to oestrone. These tests, which were performed shortly after menstruation, evoked a serious general reaction consisting of vomiting, nausea and cramplike pains in the abdomen 24 hours later. By desensitization with allergenic hormone (oestrone) relief from the disturbances

was gained. The patient remained free from symptoms during the following year, at the end of which she became pregnant.

(*b*) *Pruritus vulvae.* Cases of pruritus were submitted to examination for endocrine allergy after all other investigations had proved negative. In all these cases the complaints or the exacerbation of them related to menstruation or menopause. The duration of illness was at least one year; numerous previous attempts at treatment had been unsuccessful. Positive hormonal tests were observed in 10 out of the 13 cases in which there was an aggravation of the condition during or before menstruation, and in 5 out of the 7 cases related to menopause. The following hormones were found to act as allergens. In the menstruation cases: oestrone 4, oestradiol 1, progesterone 2, testosterone 2, corticosterone 1. In menopause: oestrone 2, testosterone 1, insulin 2. Treatment given in 10 cases was followed in 5 by recovery, in 2 by improvement, and by no results in 3 cases.

CASE 10. Mrs. B.K. Aged 37. Actress. Had been suffering for 2 years from severe pruritus vulvae which seriously interfered with her artistic activities. Menstruation aggravated the condition and led to serious skin changes with eczematous and kraurotic alterations due to secondary infection. Various types of treatment, local and general, had failed to give relief. Blood picture normal. Tests for an endogenous allergen revealed a sensitivity to progesterone, of which 0.01 mg. given intracutaneously sufficed to elicit the reaction. Specific desensitization consisted in subcutaneous injections of minimal but gradually increasing doses of this hormone. The treatment produced a marked improvement, but recurrence of the symptoms followed 2 months later. At this time a second course of desensitization, supplemented by implantation of 25 mg. of progesterone in the form of a pellet and by local inunction of the hormone in the vulvar region was given. The patient has now been free for 1½ years from all complaints and has been able to carry on her career.

CASE 11. Mrs. E.C. Aged 57. In the last 5 years suffered from persistent pruritus vulvae. Attacks had on occasion been so severe as to require morphine. Very poor general condition. Various routine measures (local and general), taken before the patient came to us—had failed to relieve this pruritus. The patient also complained of other allergy manifestations such as asthma and migraine. Blood eosinophilia 8 per cent. Pruritus vulvae and other allergic disorders became aggravated following ingestion of 50 g. of sugar. This observation at first raised suspicion of diabetic pruritus, but a subsequent blood examination showed a normal blood-sugar level of 84 mg. per cent and a glucose tolerance test presented a flat low curve such as is found in cases of exaggerated insulin secretion. It seemed reasonable that the intake of sugar had caused an aggravation of the symptoms because it had evoked increased secretion of insulin and that the latter acted as an allergen. To test this point intracutaneous tests with doses of insulin were carried out. As little as 0.0002 I.U. insulin elicited an urticarial reaction at the site of injection. Injections of 0.1 I.U of insulin with a view to desensitization provoked a severe attack of pruritus vulvae accompanied by strong migraine, general weakness, nausea and anorexia. The desensitization was performed with minimal doses of insulin, given subcutaneously and by local inunction. In this way relief from all the symptoms was obtained for 6 months. A relapse was treated with local inunctions of insulin ointments (2 units of insulin pro 1.0 g. of lanolin vehicle). Complete freedom from symptoms was maintained by the repetition of desensitization treatment every half year.

ENDOCRINE ALLERGIC REACTIONS OF THE OCULAR SYSTEM.

We have found that certain cases of ocular diseases of unknown origin may depend upon endocrine allergy. The cutaneous tests with hormones showed a positive response in 1 case of chronic recurrent conjunctivitis, and in 3 cases of superficial keratitis.[8] The ocular manifesta-

[8] Since this paper has been concluded, we observed 5 cases of keratitis rosacea showing positive reactions to testosterone only; they will be described in another paper.

tions of endocrine allergy will be described in detail in another paper. Three cases of superficial keratitis in which distinct aggravation related to menstruation are analysed below.

Superficial Keratitis. Out of 3 cases of superficial keratitis of unknown origin,[9] 2 were found sensitive to corticosterone and 1 to androsterone. The beneficial influence of desensitization in the 2 corticosterone sensitive cases was quite remarkable.

CASE 12. Mrs. R.F. Aged 41. Suffered during the last 4 years from superficial keratitis which became aggravated regularly during the last week of the menstrual cycle. At such times the corneal changes were pronounced, ocular vision was very limited, and severe ocular discomfort associated with excessive tear-shedding appeared. The symptoms had obliged the patient to suspend normal activity for about a week each month. Various ophthalmological treatments brought no relief. Urticaria had been experienced some years before. Blood eosinophilia 5 per cent. No allergy had been recorded in the family history. The endocrine allergy tests revealed sensitivity to corticosterone. Desensitizing treatment with this hormone produced most impressive results: the subjective complaints subsided completely; the corneal opacities were found at ophthalmological examination to have disappeared. During a period of observation which lasted 2 years, no recurrence of discomfort in vision occurred, and at the end of this period the patient was released as cured.

ENDOCRINE ALLERGY AS A CAUSE OF PREMENSTRUAL FEVER.

Fever appears rarely in allergy. It can be elicited by certain exogenous allergens (serum sickness, drug allergy, certain cases of hay-fever, etc.), and may occasionally be observed during the premenstrual period. In several cases observed by us high premenstrual temperatures were followed by normal temperature throughout the first phase of the menstrual cycle. These time relations strongly suggest the existence of some connection between the manifestations of fever and the secretion of the sexual glands.

Premenstrual fever. Three women in whom fever with temperature as high as 39°C. recurred in the last week preceding menstruation were positive in cutaneous hormone tests, 1 to oestrone and 2 to testosterone. Desensitization by administration of increasing doses of the allergenic hormone was performed in 2 of these cases (1 oestrone and 1 testosterone). In both cases the treatment procured absolute relief.

CASE 13. Mrs. S.P. Aged 28, married; regular menstruation. In the past 2 years she had suffered from a fever closely synchronized with the menstrual cycle, arising always on its 20th and 21st day, reaching a peak (38.5 to 39°C.) shortly before the flow, and subsiding with sudden fall of temperature and subsequent relief from fever for 3 weeks after the onset of the flow. At gynaecological examination no inflammatory process was disclosed. General examination, X-ray picture of lungs, blood examination for malaria and Malta fever gave negative results. A blood picture made at the peak of the fever showed slight leucocytosis (9,600) with marked lymphocytosis ((4 per cent) and slight eosinophilia (4 per cent). Sedimentation test normal. In cutaneous tests with hormones a strongly positive skin reaction to oestrone was obtained. Desensitization with gradually increasing doses of oestrone spaced over one cycle prevented recurrence of the fever for 2 months, after which the patient stopped coming for further observation.

THE TREATMENT OF ENDOCRINE ALLERGY.[10]

In the treatment of endocrine allergy the following 4 methods are used by us:

[9] We are indebted to Professor A. Feigenbaum, Dr. Mitterstein and Dr. Landau, who referred these cases to our department.

[10] We are indebted to Dr. B. J. Brent, Roche-Organon, Inc., Nutley, N.J., for the generous supply of the steroid hormones for desensitization.

(*a*) *Specific desensitization and its mechanism.*

The ultimate aim of the specific desensitization is the protection of the diseased organ (shock organ) from the reaction between its cellular fixed antibodies and the allergen. It is achieved by the regular administration of small, increasing amounts of the allergen into the skin tissue. Under this treatment free antibodies are formed, circulating in the blood; when the offending antigen enters the blood stream, it is bound by free antibodies and cannot react with the fixed ones of the shock organ. Unfortunately the free antibodies are rapidly eliminated after the discontinuance of the treatment, and the renewed contact with the allergen may then induce allergic reactions. Therefore, in treatment of allergic diseases, it seems advisable to maintain the supply of small amounts of allergen for a long period of time. In endocrine allergy, the slow and prolonged desensitizing action of hormonal allergen is obtained by subcutaneous injections of oily solutions of steroid hormones, since these substances, not being easily soluble, require a relatively long period of time for their absorption; furthermore, the "depôt method" by implantation of small crystalline pellets of steroid hormones (described below) provides a slow and continuous supply of minimal amounts of the allergenic hormone. However, the antibodies in circulating blood formed by minimal amounts of the allergen are not always sufficient to protect the shock organ, since any massive re-exposure to the injurious substance may elicit allergic reaction, even during the course of desensitization treatment.

The skin, through its selective function in immunity reactions, seems also to intervene in the mechanism of desensitization (Heise, 1945). In fact, proofs are available that the skin is particularly active in antibody production (Tufts, 1937), and may bind by its cellular antibodies considerable amounts of the allergen. It seems also possible that during the course of desensitization, the skin injected with the allergen may act as an additional shock organ and neutralize at the skin site those quantities of the allergen which have not been bound by the free blood antibodies (Heise, 1945). The skin seems also to participate in the desensitization mechanism of endocrine allergen. The frequent reactivation of the previous intracutaneous tests when the hormonal allergen reaches its peak concentration in the body (either after injection, "recurrent reaction", or spontaneously, "retarded reaction" and "periodic retarded reaction") points to the antigen-antibody reaction at the skin site. The skin acting as an artificially produced shock organ may occasionally protect the original allergic tissue, and thus prevent the allergic manifestation.

The following methods have been used for specific desensitization of endocrine allergic manifestations:

1. *Subcutaneous injections.* In this method, antigenic hormone is injected in small but gradually increasing amounts, at regular intervals, usually one day. Three concentrations of steroid hormone in oil (0.01 mg./ml., 0.1 mg./ml., and 1 mg./ml.) are prepared. Before beginning the treatment the sensitivity of the patient is estimated on the basis of a check test in which 0.1 ml. amounts of the mentioned solutions (equivalent to 0.001, 0.01 and 0.1 mg. amounts of the allergenic hormone) are given intradermally. Treatment is usually started with a subcutaneous injection of the smallest dose in oil which elicited a positive intracutaneous reaction in the check test. If a general reaction (urticaria, headache, vomiting, fever, etc.) is evoked by the cutaneous test, an even smaller dose of the specific allergen had best be

used to start with. The injections are given once daily, the dosage of allergen being stepped up gradually to a maximal single dose of 1 mg. The total course of treatment generally comprises 20 to 30 injections. The rate at which the allergenic hormone dose can be increased depends on the reactions of the patient. These may be of 2 kinds: local and general. The local reactions are characterized by the appearance of reddening and itching at the site of a previous intradermal test ("recurrent reaction"), or by pains and infiltration at the site of a desensitizing injection. Increase of dose should not be attempted before disappearance of these reactions. The general reaction is characterized by fever, urticaria, headache, vomiting and nausea. Any of these symptoms is a contra-indication of dose increase.

In desensitization to insulin, the hormone in aqueous solution (1 ml. = 1 I.U.) was injected in doses which were gradually increased from 0.1 to 1.0 units. In desensitization to chorionic gonadotrophin, korotrin in aqueous solution was injected in doses which were increased from 1 to 100 units. Our limited experience of sensitivity to gonadotrophin does not permit definite conclusions as to the efficacy of this method of desensitization.

2. *Implantation of hormone-pellets ("depôt method").* In some patients, relapses occurred a few months after the injection treatment, and thus showed that the desensitization induced had only been temporary. A second course comprising 10 injections, starting from a dose of 0.1 mg., which was gradually increased to 1.0 mg., was instituted in these cases, and at its completion a pellet containing 15 to 25 mg. of the antigenic steroid hormone was implanted. It might be feared that the deposition of a pellet containing a significant dose of antigenic hormone could possibly reactivate the allergic reaction. However, this mode of treatment proved efficacious and elicited no harmful side-reaction.

Other authors (Geber, 1939: Urbach, 1943) have employed another "depôt method" in desensitization treatment by repeated intracutaneous injections of the allergen at the same skin site, also with good results.

3. *Percutaneous desensitization.* It has been shown by us that genital hormones can be absorbed by the body through the skin (Zondek, 1929: 1935b). We have made use of this property to effect specific desensitization. Apart from the local effect so induced in the affected tissues, desensitization is obtained because of the penetration of hormone into the circulation. This percutaneous method was employed, alone and in combination with injections, in 4 cases of pruritus vulvae and in 4 cases of acne. 1 to 2 mg. steroid hormone in lanolin (1 mg. of hormone in 1 g. of vehicle) was applied percutaneously daily.

The local method of desensitization by application of gradually increasing doses of allergen ointment on the affected tissue has a widespread use also in other forms of allergy, especially in various forms of allergic dermatitis (Mackenzie and Baldwin, 1921: Gongerot and Meslin, 1938). However, this method does not permit accurate dosage of the allergic hormone applied, and the desensitization requires a long-lasting period of treatment.

Results of specific desensitization.

Desensitization treatment in its various modifications has now been applied in a total of 47 cases (Table II). In this group, 24 patients (51 per cent) recovered, 13 (28 per cent) improved, and 10 (21 per cent) showed no amelioration. Untoward effects from the treatment were rare and consisted in fever (38°C.) 2 cases, nausea and vomiting 2 cases, headache 1 case, and urticaria 1 case.

(*b*) *Elimination of Allergenic Hormone by specific interference with its Production.*

The observation that large doses of oestrogen or testosterone may inhibit the gonadotrophic function of the hypophysis (Zondek, 1936a; 1936b; 1937; 1938; 1940; 1941a: Geist, 1941: Salmon, 1941) made it possible to eliminate certain hormones from the circulation. We employed this method in 2 cases in order to spare the organism contact with the allergenic hormone. In one case sensitive to gonadotrophic hormone with migraine in menopause, the production of the allergenic hormone was inhibited by the administration of high doses of testosterone (400 mg. of testosterone propionate in 8 days). Recovery was effected by this treatment (case 8). In a case sensitive to oestrone with pruritus vulvae in early menopause, the administration of oestrone was contra-indicated in view of the carcinogenic disposition (patient had undergone an operation for cancer of the breast 3 years earlier). Administration of testosterone in high doses (400 mg.) was followed by recovery. This method of treatment, namely, administration of large doses of oestrogens or androgens to cause pituitary inhibition, is not advised for regularly menstruating women, since the inhibition of the gonadotrophic function so induced delays menstruation (Zondek, 1936c: 1941b). The method should be applied mainly on menopause patients who show sensitivity to gonadotrophic hormone, oestrone, or to testosterone. In cases of sensitivity to gonadotrophic hormone, the hormonal allergen may be eliminated by administration of high doses of testosterone or oestrogens. If testosterone is the allergen, inhibition of its production will be produced by high doses of oestrogenic hormone. In cases of sensitivity to oestrogens, on the other hand, testosterone should be employed for pituitary inhibition.

TABLE II.

Results of Desensitizing Treatment.

Diseases treated	Number of cases treated	Desensitization treatment	Treatment through inhibition of pituitary secretion	Recovery	Improvement	No results
Asthma	3	3	–	1	2	–
Vasomotor-rhinitis	2	2	–	1	1	–
Angioneurotic oedema	2	2	–	2	–	–
Chronic urticaria	4	4	–	2	2	–
Chronic eczema	1	1	–	–	–	1
Acne	3	3	–	–	2	1
Migraine	8	7	1	4	2	2
Superficial keratitis	2	2	–	2	–	–
Premenstrual tension	12	12	–	7	2	3
Pruritis vulvae	10	9	1	5	2	3
Premenstrual fever	2	2	–	2	–	–

COMMENT.

Allergic manifestations are elicited as a rule by exogenous antigens. The observations reported in this paper demonstrate the possible existence in man of allergic sensitivity to endogenous secretory products of the endocrine glands. This peculiar condition is readily comprehensible in relation to the protein or protein-like secretions, e.g., anterior and posterior pituitary hormones, thyroid hormone, insulin, and chorionic gonadotrophin. It has been assumed (Glass, 1936) that pre-menstrual headache can be due to hypersensitivity to the pituitary gonadotrophic secretion. Furthermore Lowell (1942) found that positive cutaneous reactions are induced by an intracutaneous injection of an extract of human pancreas. Urbach (1939) explained the aggravation of acne and eczema during the pre-menstrual phase as due to the presence in the blood of such patients of an endogenous allergen. His patients showed positive skin reactions to their own serum. The existence of allergic reactions to steroid hormones is a less expected observation. Allergic reactivity to steroid hormones can be demonstrated by intradermal injection of the steroid allergen in a vehicle of oil. It is known that various oils can evoke reactions of an allergic nature. However, olive oil prepared according to the prescription of the Pharmacopeia Helvetica and heated for at least 48 hours at 100°C. produces such reactions in only 7.5 per cent of healthy cases. No ideal uniformity in different vehicles has yet been found. Individuals sensitive to oil alone were therefore excluded from the case material of this study. In a certain number of patients with positive cutaneous reactions to oestrone or oestradiol in an oil vehicle, positive reactions were also obtained when the hormones were given in physiological saline when they were injected intradermally. Cases sensitive to testosterone in oil reacted allergically to this hormone also when it was injected intradermally in the form of a suspension of crystalline testosterone in normal saline. These observations constitute a further proof that the allergen of the reported cutaneous reactions is in fact the steroid hormone rather than its vehicle.

As has been shown, blood from a patient hypersensitive to a steroid hormone contains a specific reagin to the hormonal allergen (Zondek and Bromberg, 1945). Serum of such a patient when it is transferred into the skin of normal women elicits a positive Prausnitz-Kuestner reaction. In certain cases, serum containing such a reagin elicits the positive skin reaction when the concentration of allergenic hormone in the body of the normal subject climbs to a sufficient level ("endogenous passive transfer test"), e.g., at physiological peak, or after injections of the allergenic hormone.

Allergic manifestations (like asthma, hay-fever, urticaria, etc.) can be caused not only by exogenous glands but also by endogenous secretory products of the endocrine glands acting as allergens. In general, however, the latter aetiology should be taken as a probable explanation only where the clinical manifestations are related to the genital functions.

It has been found that premenstrual pain and various other premenstrual disorders (nausea, vomiting, fever, etc.) are often of an allergic nature. The same symptoms have a different origin when they occur during menstruation. Pre- and intra-menstrual disorders seem, in other words, to be aetiologically entirely different. Allergic dysmenorrhoea characterized by pain before the menstrual flow must thus sharply be separated from essential dysmenorrhoea in which pains occur during menstruation. Essential dysmenorrhoea cannot be regarded as an endocrine allergy

condition, since in 11 cases of this kind examined by us, cutaneous tests revealed not a single positive response.

A varied range of clinical manifestations related to menstruation or menopause (premenstrual tension, migraine, urticaria, and pruritus vulvae) may be due to endocrine allergy, though they need not necessarily be of this origin. On the other hand, hypersensitivity to different hormones can become manifested clinically in the same disorder. Thus, out of 5 cases of chronic urticaria, 2 were found to be associated with sensitivity to oestrone, while the remaining 3 cases were associated respectively with sensitivity to progesterone, testosterone and corticosterone.

In the treatment of pruritus vulvae by percutaneous inunction of steroid hormone as introduced by the senior author (B.Z.), it is probable that desensitization of the patient by means of small amounts of resorbed hormone (about 15 per cent) is the factor responsible for the favourable results which are obtained. The fact that a given percutaneous ointment treatment relieves pruritus vulvae in some cases and not in others is readily comprehensible under this view which postulates the existence of a *specific* hormonal allergen. The method of intracutaneous tests makes it possible to determine with greater precision the hormone which it is proper to apply in this way.

Our study of endocrine allergy has been made exclusively in women, as in them the cyclic nature of the genital functions provides a convenient means of demonstration of the existence of an endocrine allergic condition. The available evidence points, however, also to the existence of conditions of hypersensitivity to endogenous hormones in human males as well. It seems not unlikely that the intracutaneous test technique will prove useful as a means of detecting conditions of this kind in men.

In *normal* women with regular periods the cutaneous reaction to the hormones tested was in no case found to be positive. The high level of the incidence of endocrine allergy in the cases reported above results from case selection and should not be regarded as forming evidence that endocrine allergy is a frequent occurrence. The cases we have described were all selected from a group which had proved resistant to all common methods of treatment, and in which the symptoms of the complaint related to the genital functions. In general practice, endocrine allergy is not often encountered.

Summary and Conclusions.

1. Sixty-six cases in which sensitivity towards endogenous hormones gave rise to various pathological manifestations are reported. Hormonal allergy was detected by skin tests with oily hormone solutions injected into a layer of the epidermis deeper than that used for ordinary skin tests with aqueous solutions.

2. In healthy women endocrine allergic conditions of this nature were never encountered at any phase of the sexual cycle.

3. Endocrine allergic conditions are not frequent. They have a considerable rate of incidence, however, in disturbances related to menstruation or menopause.

4. Clinical manifestations of "endocrine allergy" as so far encountered have been divided according to the organs thus involved. The possible clinical involvement in such cases of the respiratory, cutaneous, nervous, genital and ocular systems is illustrated.

5. The following ailments have been identified as due in certain cases to "endocrine allergy":

(a) Respiratory tract: asthma and vasomotor rhinitis;

(b) Cutaneous system: angioneurotic oedema, chronic urticaria and acne;

(c) Nervous system: migraine;

(d) Genital system: premenstrual tension and pruritus vulvae;

(e) Digestive system: nausea, vomiting, diarrhoea and epigastric pains during the premenstrual phase;

(f) Ocular system: chronic, recurrent conjunctivitis and certain forms of keratitis (as superficial keratitis and keratitis rosacea);

6. The following 4 methods of treatment for endocrine allergy are proposed:

(a) Desensitization by the subcutaneous injection of the hormonal allergen in question in a series of doses of gradually increasing size;

(b) Desensitization by the "depôt method" involving the implantation of hormone-pellets. This method is applied after it has been advanced to a point at which the patient can already tolerate a fairly high dose of the hormone in question;

(c) Desensitization by percutaneous treatment with hormone ointment;

(d) Elimination of the allergenic hormone from the body by the inhibition of the gonadotrophic hypophyseal function with large doses of oestrogens or androgens.

7. In 47 cases of endocrine allergy treated by specific desensitization the following results were obtained: complete recovery in 51 per cent, improvement in 28 per cent, and negative results in 21 per cent. In 2 cases the allergenic hormone was eliminated by the inhibitory effect of high doses of tostesterone on pituitary secretion.

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The Use of Radiology in Predicting Difficult Labour*

BY

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LECTURE 2: Forecasting the Course of Labour

FEATURES OF A GOOD OBSTETRIC PELVIS

AMONG the various anatomical features revealed by radiography the following are tokens of easy delivery:

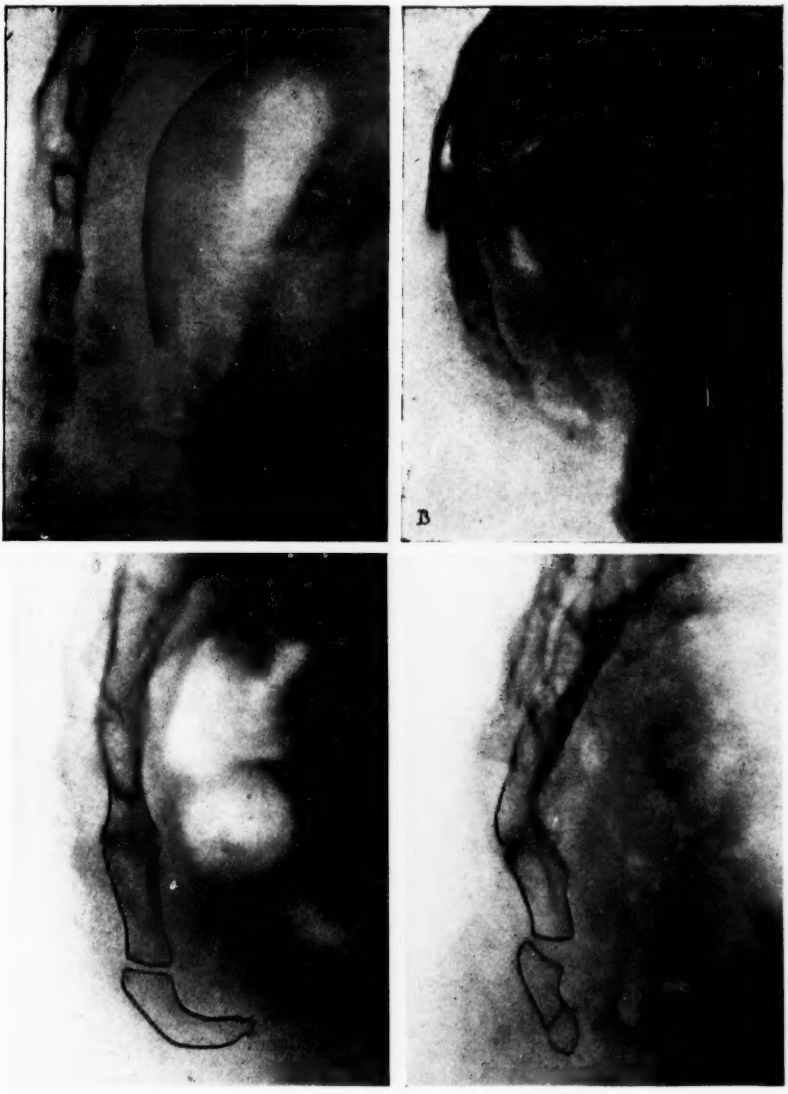
The obstetric conjugate is adequate in size. This diameter is measured on the lateral radiograph from the inner margin of upper part of the pubic bone to the nearest part of the sacrum—which may be the promontory itself or, more usually, a point below the promontory at which the brim outline is seen to intersect the sacrum.[25] This and other measurements are shown in Table I. Two hundred years ago, Smellie stated that the *true* conjugate (which is about 5 mm. greater than the *obstetric* conjugate) measured $4\frac{1}{4}$ inches (10.8 cm.), and this low value seems to have been widely quoted in subsequent obstetric literature. Greulich and Thoms[15] and Nicholson[16] have brought forward good reasons for supposing that the size of the brim conjugate is largely dependent on diet during adolescence, and in a recent investigation of healthy women in a rural community a value as high as 12 cm. ($4\frac{3}{4}$ inches) has been obtained for the obstetric conjugate (Nicholson).

The sacrum shows a full, even curve from above downwards. In consequence, the sacro-sciatic notch should be wide, and almost as open below as it is above (Fig. 7, D). The wide sweep of the sacrum also gives an adequate lower antero-posterior dimension to the pelvis, measured from the inner lower border of the symphysis to the tip of the sacrum (Table I). Sometimes the first coccygeal segment is fused to the sacrum; and if the coccyx also projects sharply forward (Plate XI, B and C) it may then obstruct delivery. Allowance should be made for this possible abnormality when measuring the lower antero-posterior diameter. I conveniently call this modified measurement the *available* lower antero-posterior diameter (see also later section). Occasionally, an inward-pointing coccyx may be dislocated or even fractured during the birth of the head—an event sometimes encountered when traction is made on the forceps to overcome an arrest of the head in a low pelvic position (Plate XI, D).

The pubic bone and its descending ischial rami are nearly parallel to a line joining the sacral promontory to the sacral tip. Any marked convergence from above downwards indicates the possibility of outlet con-

* The second of two Ingleby Lectures delivered at the University of Birmingham, May 1946. The first lecture, "Technical Considerations in Pelvimetry and Cephalometry", appeared in the last issue of the *Journal*.

A B



C D

PLATE XI.

Variations of the coccyx. A. Normal coccyx being pushed back by the descending foetal head. B. Inturned coccyx with fused sacro-coccygeal and inter-coccygeal joints. C. Coccyx sharply inturned. D. Coccyx fractured (or dislocated) at inter-coccygeal joint following arrest of head at outlet (low forceps delivery).

C. M.

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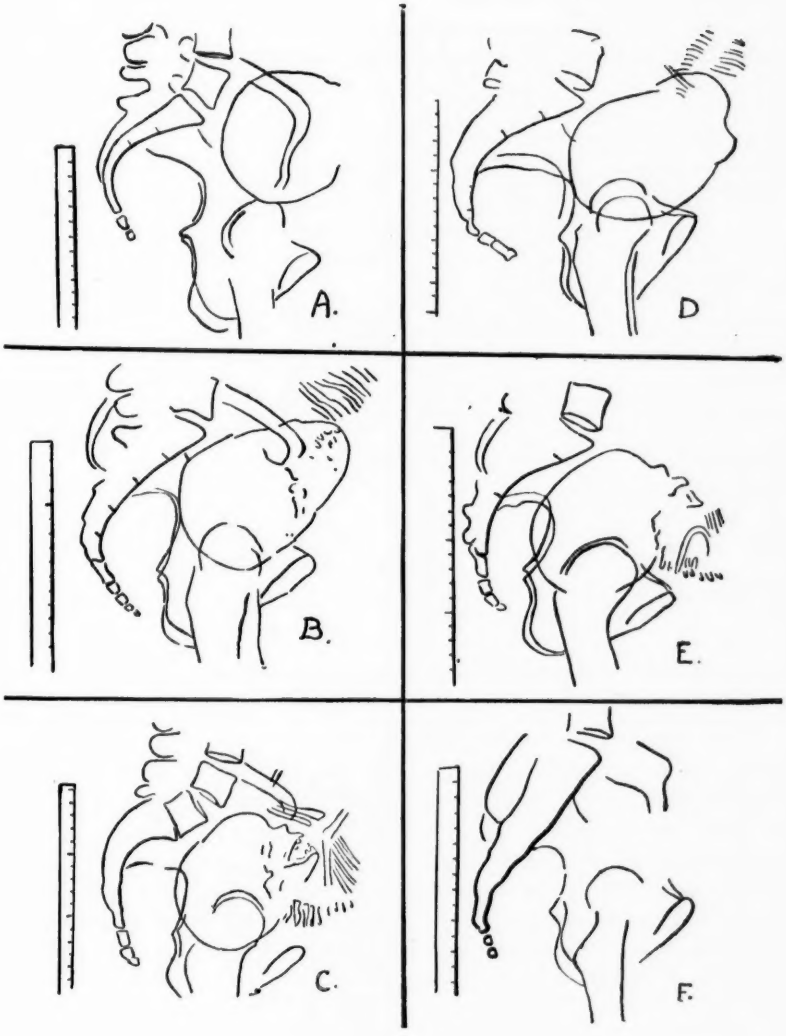


FIG. 7.

Tracings obtained from lateral radiographs. A. Short sacrum (shallow pelvis). B. Long sacrum (deep pelvis). C. False promontory. D. Wide sacro-sciatic notch. E. "Closed" sacro-sciatic notch. F. Flat sacrum.

traction (Fig. 7, E). A more accurate indication of this latter feature is the size of the posterior sagittal diameter of the outlet; a point is marked midway between the ischial tuberosities (if these are not already superimposed) and the distance measured from this point to the tip of the sacrum, or to the first inter-coccygeal joint if the coccyx is fused to the sacrum (Table I).

TABLE I.
RADIOGRAPHIC MEASUREMENTS OF THE PELVIS
(Average values, with Standard Deviations in brackets.)

	Nicholson	Ince and Young	Oxford. Selected, but spontaneous delivery	Oxford. Unselected
Obstetric conjugate ...	11.6 (1.0)	11.8 (1.0)	11.2 (0.9)	11.8
Transverse of brim ...	13.2 (0.76)	13.1 (0.7)	12.6 (0.6)	12.9
Available transverse brim	— .	— .	—	12.4
Lower antero-posterior ...	13.0 (0.96)	12.0 (0.86)	—	—
Available lower antero-posterior ...	—	—	11.4 (0.9)	11.7
Bi-spinous	10.5 (0.77)	9.95 (0.71)	10.1 (0.7)	10.45
Posterior sagittal of outlet	—	—	8.6 (0.9)	8.9
Sub-pubic angle	84.8° (7.3°)	—	81.2° (7.3°)	86°

The transverse diameter of the brim is adequate, and the posterior segment of the brim outline is well rounded. The dimension of the transverse diameter is shown in Table I. Usually it exceeds the obstetric conjugate by about 1.5 cm. If the two are equal, or if the antero-posterior exceeds the transverse (dolichopelly, or "anthropoid" pelvis (Plate II), an occipito-posterior position of the head will usually result. This was first pointel out by Thoms[17] in 1932 and has been amply confirmed by subsequent workers. A wedge-shaped brim (the android* pelvis of Caldwell and Moloy) is unfavourable because the widest transverse diameter is too near the sacrum to be available for the foetal head (Plate III). This feature can also be described by saying that there is a short posterior-sagittal diameter of the brim.

* Investigations by Thoms and Greulich (*Amer. Journ. Obstet. and Gynecol*, 1940, xxxix, 56), and by Ince and Young (*Journ. Anatomy*, 1940, lxxiv, 374), have shown that the brim of the male pelvis is usually well rounded and has no special tendency towards a wedge shape; it is therefore singularly inappropriate that this type of brim should be termed "android". But the male pelvis has a narrow pubic arch and a smaller bi-spinous diameter than has the female pelvis, and there is also a distinct tendency to funnelling from above downwards—features which if found in a female pelvis do merit the term "android". There is no close relationship between the shape of the brim and the shape of the outlet.

If the shortened posterior sagittal diameter is continued into the pelvic cavity, as evidenced by a flattened sacral curve, prognosis is considerably worsened.

The limbs of the pubic arch diverge widely enough to accommodate the head with little wastage of space under the apex of the arch. A narrow arch will cause the head to be forced backwards with consequent danger of severe (third degree) perineal rupture (Fig 8). If the narrow arch is also associated with a forward projecting sacral tip or fused coccyx (causing a shortening of the lower antero-posterior, and posterior sagittal outlet diameters) delivery may be arrested by an outlet obstruction. It is in this latter type of case that a well-timed symphysiotomy is sometimes a conspicuously successful operation. The average measurements of the subpubic angle and of the posterior sagittal are shown in Table I.

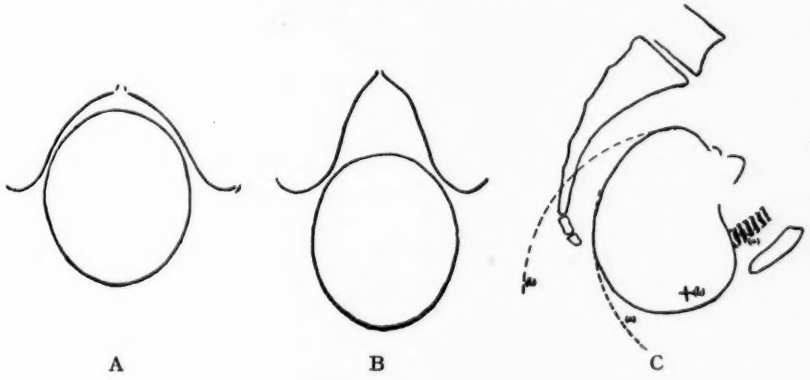


FIG. 8.

A narrow pubic arch pushes the foetal head further back with risk of severe perineal tear. If there is also a forward-projecting sacral tip, obstruction may result. The arches shown in A and B are actual tracings obtained from radiographs. (Redrawn from Nicholson, *loc. cit.*)

The foetal head is moderate in size relative to the pelvis and is favourable in position. The size, relationship to the pelvis, position and level of the foetal head are all best studied in the lateral X-ray of the pelvis. The average bi-parietal diameter is about 9.3 cm. A diameter of more than 9.6 cm. represents a distinctly large head with corresponding likelihood of difficulty during delivery. The relationship of the head to the pelvis is of special importance. Usually the long diameter of the head lies in, or nearly in, the transverse diameter of the brim; and normally there is space to spare between the parietal bones and the pelvic walls, both in front and behind (Fig. 7). The head should be well flexed; usually it is also tilted towards its posterior shoulder. The position of the head is best ascertained by identifying the relative positions of the foetal vertebral column and the mandible.

THE INTERPRETATION OF RADIOGRAPHIC FINDINGS.

The various radiographic features just mentioned are used to " size-up " a case of supposed cephalo-pelvic disproportion, but their interpretation, even for an experienced worker, necessarily calls for much care and

judgment. Many attempts have been made to simplify matters.

Area Measurement. Nicholson[18] has stressed the importance of the *brim area* which, he has shown, can be approximately estimated by assuming that the brim is elliptical, and using the appropriate formula (π times half the minor, multiplied by half the major axis). He states that when the area is reduced to 90 sq. cm. the level of uncertainty is reached; or, more exactly, that a brim with an area of 110 sq. cm. can pass 99.9 per cent of heads; a brim of 100 sq. cm. can pass 97 per cent; a brim of 90 sq. cm. can pass 70 per cent; but that a brim of 80 sq. cm. can pass no more than 21 per cent of foetal heads.[19] While not routinely measuring the foetal head, he estimates that for easy delivery the relationship of the area of the head at its bi-parietal level—which he assumes is circular—to the area of the brim should not exceed 70–80 per cent.[20]

Nicholson maintains that although pelvic brims vary considerably in shape (pelvic index), those with equal area have equal obstetric value. In making a prognosis he lays emphasis on the pelvic rather than on the foetal size.

The area required at the level of the ischial spines—"the plane of least pelvic dimensions"—is less than that required at the brim. According to Nicholson an uncertainty is caused by the fact that in many cases the lower part of the pelvis expands during the labour so that an easy delivery may take place even when difficulty seemed inevitable. (I am fully in accord with this opinion, and believe that the bi-spinous diameter in particular increases under the influence of the outward thrust exerted by the descending foetal head.)

Unquestionably, Nicholson's method of area measurement is helpful, although there are many cases (e.g. those in which the foetus is unusually big or unusually small) in which it must leave the obstetrician in some doubt regarding the outcome of labour.

Pelvic Charts. Early in his work Thoms[21] devised a "pelviscope" by which a tracing could be made from the radiograph showing the true size and shape of the pelvic brim. Some years ago I[22] proposed adding the outline of the flexed head to the tracing so obtained, thus making it possible to reveal in a more obvious form the main features of the cephalo-pelvic relationship that is likely to obtain when the patient goes into labour (Plate XII).

Rohan Williams[23] has recently used a somewhat similar method which he has developed further by adding a chart of the lateral view of the pelvis (reduced to true size). On these charts he superimposes a circle representing the size of the foetal head. By thus picturing the pelvis in two projections he finds that he can forecast the course of subsequent labour with a considerable degree of accuracy. In a very recent publication[24] he presents excellent results by the use of this method.

Despite these favourable remarks, this approach to the problem is not, in my opinion, completely satisfactory. Firstly, the construction of the charts is an exacting and time-consuming occupation. Secondly, the fault hitherto so manifest in this class of work—namely, that radiographic interpretation is impressionistic rather than factual—is not entirely overcome.

The Graph Method. This brings me to the focal point of these lectures, and I now wish to present a method which has gradually evolved in the course of my investigations and which has greatly simplified the interpretation of the radiographs.

As the head descends through the pelvis from brim to outlet it passes through a

channel constantly varying in shape. Ideally, therefore, one should record the shape and size of an infinite number of cross sections of the birth canal, and ascertain for each the cephalo-pelvic relationship. This is impracticable; but for general purposes it is sufficient to consider the antero-posterior and the transverse diameters of (1) the brim, (2) the pelvic cavity at the level of the ischial spines, and (3) the outlet. It is now necessary to define these levels more exactly, particularly as none of them, strictly speaking, is a true plane.

The Brim. Contrary to orthodox teaching the promontory of the sacrum is not usually the important posterior landmark; this is because the outline of the brim—as can be seen by examination of a dried pelvis—crosses the sacrum and naturally terminates at the junction of the first and second sacral segments, or at a point between that and the promontory.[25] This dimension is often a few millimetres less than the conventional obstetric conjugate. In this work the *Antero-posterior Diameter* of the brim means the shortest distance between the upper and inner margin of the symphysis pubis and the nearest part of the sacrum—usually the point just mentioned, but sometimes, if the sacrum is short or is well curved, the promontory itself.

Again contrary to orthodox teaching, the greatest transverse diameter of the brim is not the measurement that is found to be of chief value. In my work the transverse measurement refers to a diameter which intersects the conjugate of the brim at the mid point; this measurement I conveniently designate the *Available Transverse Diameter.* The reason for this selection is as follows: In a round (gynaecoid) pelvis the widest transverse dimension is situated well forward, coinciding, or nearly coinciding, with the available transverse diameter: in a pelvis of this shape the foetal head can make full use of the space available at the brim, and prognosis is, generally speaking, good. If, however, one is dealing with a pelvis showing a wedge-shaped brim, the widest transverse diameter is situated near to the sacrum: the foetal head cannot then make use of the space available and the prognosis is correspondingly bad. In this latter case the available transverse diameter is far in front of the widest transverse diameter and measures much less; it therefore furnishes a better indication of the restricted obstetric value of this type of pelvis.

The Cavity. The lower antero-posterior measurement is taken from the nearest point of the inner margin of the symphysis pubis to the tip of the sacrum. If the coccyx is seen to be fused with the sacrum the measurement is taken to the first free intercoccygeal joint. Sometimes it is impossible to be sure of the mobility of the sacro-coccygeal joint from X-ray examination, and it is then necessary to make a clinical test; a finger is passed into the rectum, the coccyx is gripped between the forefinger and thumb, and the point where movement takes place is identified.

The *Transverse Diameter of* the cavity is reckoned as the distance between the ischial spines.

The Outlet. Various methods of estimating the obstetric value of the outlet have been tried. The simplest is to measure the sub-pubic angle and, as will be explained, to use this measurement in conjunction with the posterior sagittal dimension of the outlet. (These measurements have been defined in a previous section.)

The evolution of the present method can now be explained. Three types of charts were prepared, one for the brim, one for the cavity and one for the outlet. In each, the antero-posterior dimensions were marked vertically, and the transverse dimensions horizontally. By pin-pointing a spot on each of the three charts the main facts regarding the size and shape of any particular pelvis could be recorded.

Separate sets of three charts were made for each size of foetal head from 9.0 cm. to 9.9 cm. bi-parietal diameter—that is, 10 sets of charts in all. (Cases in which the head measured less than 9.0 cm. were discarded from the present investigation.)

All the collected cases for which complete radiological and clinical data were available (including the post-natal measurement of the bi-parietal diameter of the head made by myself) were now entered on the charts. For each easy delivery a cross was made and for each difficult delivery a nought.

The definitions adopted for easy and difficult delivery were as follows. By *easy delivery* was meant a spontaneous delivery occurring within 30 hours in a primigravida, or 24 hours in a multipara. (If uterine contractions definitely ceased for a long period during the labour this fact was taken into consideration, but an adjustment of this nature was made in very few cases.) By *difficult delivery* was meant a labour in excess of the above-stated times (with the same reservation), or a delivery requiring forceps, or a delivery requiring Caesarean section after a trial of labour.

When the completed charts were examined it was at once apparent that the majority of "easy" deliveries fell on to the top right-hand part of each chart while almost all the "difficult" deliveries fell on to the lower and left side of one or other —or a combination—of the three charts. A dividing line could be marked out on each chart which substantially separated the one class of case from the other. Thus each chart sifted out, as it were, the type of case in which difficulty at that particular level was encountered (Fig. 9).

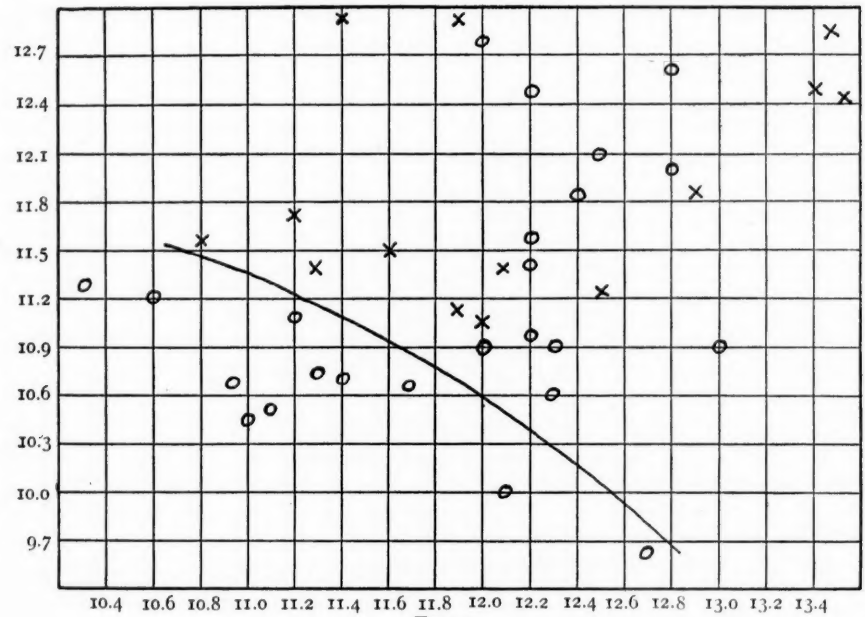


FIG. 9.

Specimen chart showing easy and difficult deliveries arranged in accordance with brim size (see text). Antero-posterior brim measurements are recorded vertically, and available transverse measurements are recorded transversely. This chart deals only with foetal heads of 9.5 cm. biparietal diameter. Note that a line can be drawn on one side of which no easy deliveries take place. Most of the difficult deliveries recorded on the "easy" side of the above chart were "sieved out" by the companion cavity and outlet charts.

Having marked out the dividing line on each individual chart, it was then possible to combine the charts and to draw up a single set of three charts showing the dividing lines for easy and difficult deliveries for each size of foetal head (Fig. 10).

These are now the key charts on which it becomes a quick and easy matter to pinpoint any pelvis and to define its obstetric value relative to the estimated size of the foetal head. It should be noted that the dividing lines have been drawn up on a pure "trial and error" basis, they are not compiled on any mathematical formula.

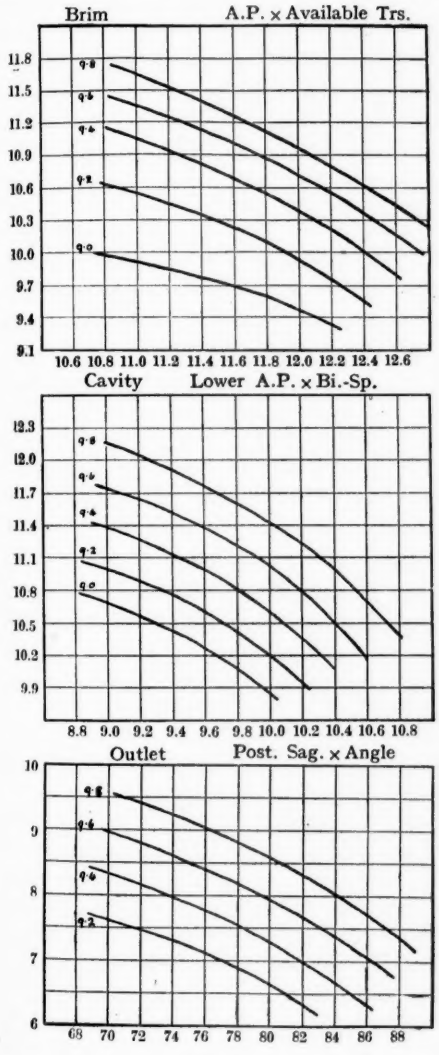


FIG. 10.
Charts showing levels at which difficulty (as defined in text) may be anticipated for each size of foetal head.

Results. The cases on which this investigation was based were far from unselected. There was heavy loading with (1) patients showing a high head at term or other clinical evidence of disproportion, and (2) puerperal patients who had had an unexpectedly difficult time in labour and who were therefore examined retrospectively. This high rate of selection has proved both an advantage and a disadvantage. On the one hand it enabled a large number of cases to be investigated of the type most useful in constructing the required graphs. On the other hand there was the disadvantage that the high proportion of border-line cases made the same material unsuitable as a fair test of the value of the graphs in indicating the probable course of labour in the general run of cases. (Even if some perfect form of pelvimetry and cephalometry could be evolved in which every possible error had been eliminated, the forecast, if restricted to a simple "yes" or "no", could not achieve more than a 50 per cent accuracy when applied to a ***strictly*** border-line group.)

A further difficulty arose from the fact that the second group just mentioned inevitably included many cases in which dystocia was caused by uterine inertia or other abnormality quite distinct from cephalo-pelvic disproportion. In other words, no one can say that in a particular case labour *cannot* be difficult or prolonged. Unexpected happenings of this sort are not therefore a disparagement of the value of the proposed method of assessing cephalo-pelvic relationship. For what they are worth the figures in this group are these: a favourable outcome was indicated in 89 cases; of these, an easy delivery did, in fact, occur in 64.

Much more interesting and useful is the

group of cases in which *difficulty* was indicated. In it a considerably higher accuracy of prognosis was found. Whereas in the previous group (the "favourable-forecast" group) certain influences sometimes made their appearance and caused the prediction to be upset, these influences if they appeared in the second group (the "dystocia-forecast" group) now operated in favour of the prediction. To use the language of the card-table, in the "favourable-forecast" group the trick was sometimes lost because the opponent produced an unexpected ace, but in the "dystocia-forecast" group the trick was unfailingly taken by the trump held in one's own hand, and the ace, if played at all, was played by one's partner! Further, if definite disproportion was present it could only be in very exceptional cases that uterine contractions were so strong, or head moulding so great, or pelvic "give" so pronounced that an easy spontaneous delivery could take place.

The "dystocia-forecast" group consisted of 104 cases. Of these 86 did in fact have difficult labours. Of these cases in which a wrong prognosis was given, 6 were border-line in the sense that had the head been only 1 mm. less in its bi-parietal diameter a favourable forecast would have been made. If these border-line cases are eliminated the prognosis was correct in 86 out of 98 cases.

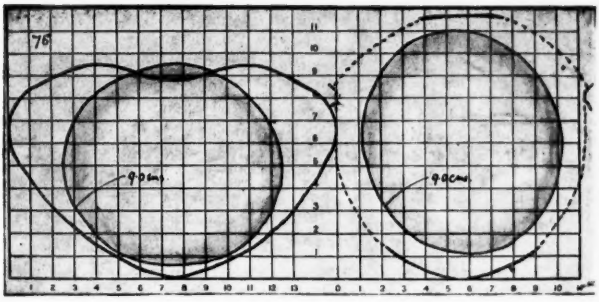
Let us now consider the 12 cases out of the 98 in which an erroneous indication was given. Of these, 8 were judged "bad" by their failure to reach the supposed safety level on the cavity or outlet graphs only, and yet an easy delivery resulted. This is a reminder that the lower pelvis may in favourable circumstances expand and so allow an unexpectedly easy delivery to occur in cases of undoubted disproportion. This expansion of the lower pelvis is oftenest seen in multiparae; and it is pertinent to note that in no less than 5 of these 8 cases a history was forthcoming of a previous difficult forceps delivery. There now remain 4 cases out of the 12 in which a wrong indication was given. Of these the foetal head was abnormally broad in 2, so that the bi-parietal measurement gave an over-estimate of head size, and caused an unfavourable indication to be obtained from the graphs. This is a rare but seemingly unavoidable source of error. Lastly, in 2 cases a wrong indication was given for which no explanation could be found.

To summarize, it can be said that *the prediction of dystocia is surest when a fault is revealed in the brim graph*. Considerable weight should be given to such evidence. If an unfavourable feature is revealed only on the cavity or outlet graphs a considerable proportion (30–40 per cent) of moderately easy spontaneous deliveries will take place, or easy forceps delivery will be possible. To ignore the evidence of the cavity and outlet graphs would, however, be dangerous, for frequently—especially in the elderly woman—the pelvis does *not* "give", and the baby's head—especially if over 9.5 cm.—does *not* mould, and a particularly difficult delivery is then encountered. Patients showing cavity or outlet faults must therefore be looked upon as cases of "suspect-dystocia" and suitable provisions made for their supervision in labour by an experienced obstetrician.

It may be questioned whether the graphs adequately cater for all the pelvic abnormalities that may be detected on examination of the pelvic radiographs. They do not; although they do cover the major features. Among the omissions the following may be mentioned:

(1) *A high inclination of the pelvic brim.*[26] If the pelvic brim is highly inclined (that is, the brim assumes a nearly vertical position when the woman stands erect) there is often a slow start to labour and the head is late in engaging. Often

A



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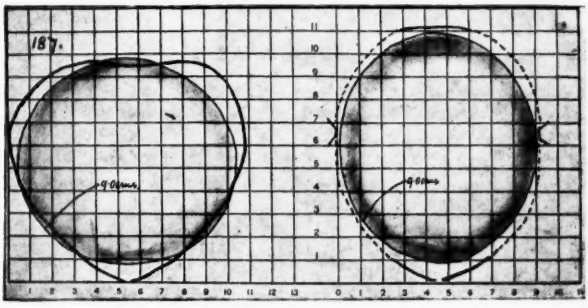

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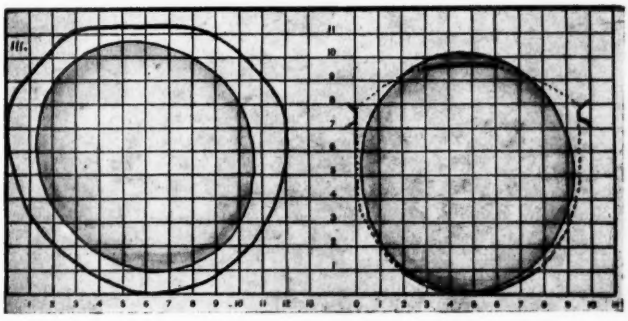

PLATE XII.

Charts showing the relationship of the flexed foetal head to the pelvis at brim level (left), and ischial spine level (right).

A. Rachitic flat pelvis. B. Generally contracted and wedge-shaped brim. C. Contracted outlet (funnel pelvis).

In Case A there was a long delay at the brim, but an easy low forceps delivery was later effected. In Case B Caesarean section was required (previous craniotomy). In Case C there was a long delay at the outlet and forceps delivery failed; subcutaneous partial symphysiotomy was then performed and a living baby easily delivered.

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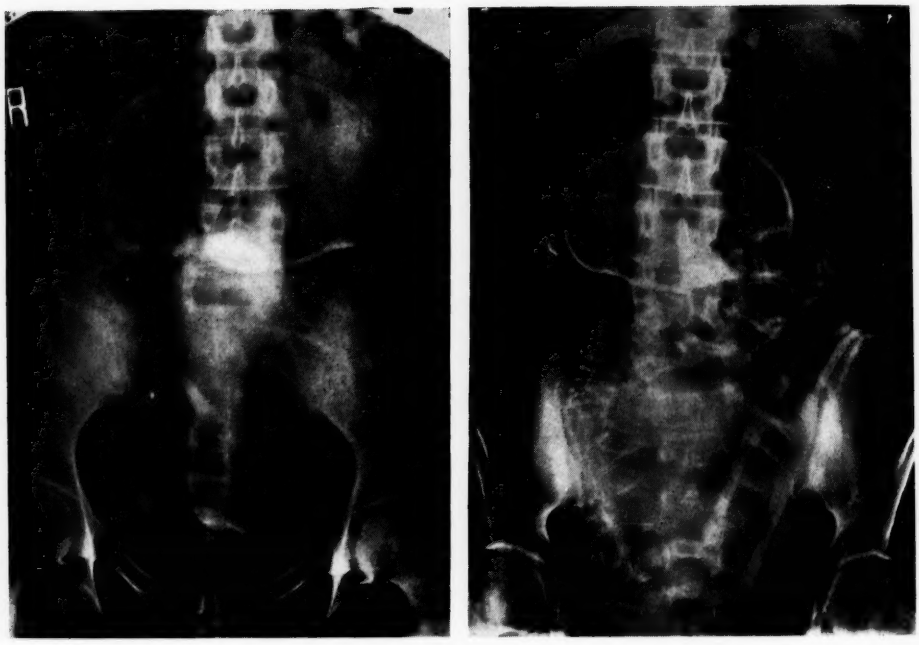

PLATE XIII.

Hydrocephaly wrongly diagnosed.

A patient arrived with a letter stating that the foetus was hydrocephalic, and requesting that operative treatment should be undertaken. Examination of the accompanying radiograph (left in above illustration) showed that it had been obtained with the patient in the dorsal position, with consequent enlargement of the foetal head out of proportion to that of the foetal body. A second picture was obtained with the patient in the prone position, and a normal foetus revealed (right in above illustration). This patient later had a normal delivery of a healthy child.

C. M.

there is also an occipito-posterior position of the head which in certain circumstances (Fig. 11) is likely to develop into an obstruction, with the occiput occupying the hollow of the sacrum and the brow pressed against the pubic bone. If therefore there is already some tendency to disproportion, the prognosis is worsened by a high inclination of the brim.

(2) *The sacrum lacks the normal full curve from above downwards.* A flattening of the sacral curve results in a lessened antero-posterior dimension of the intermediate part of the pelvic cavity (lessened posterior sagittal diameter); and if there is already a tendency to disproportion, the prognosis is correspondingly worsened.

(3) *Malposition of the head.* The significance of this complication is so obvious that it needs little comment. The head normally enters the brim in the occipito-lateral position, but any decided turning of the occiput to the posterior position, especially if combined with a sharp angulation of the long axis of the head to the long axis of the foetal trunk (Fig. 11) is liable to lead to a delay in labour, and prognosis is then worsened.

A useful way of assessing the extra difficulty likely to be encountered when the above complications are found is to assume that the bi-parietal diameter measures 1, 2, or even 3 millimetres more than the estimated dimension. In the results just presented these complications were intentionally disregarded in order that the value of the graphs could be assessed apart from any adjustments or reservations on the part of the observer. Had these adjustments been made greater accuracy in prognosis would have been reached.

Since the first object in constructing these graphs was to determine whether or not they would provide a quick and convenient method of assessing the obstetric value of the pelvis relative to the foetal head, it was desirable to eliminate as far as possible any variable or uncertain factor. To this end, the exact size of the foetal head (bi-parietal diameter) was established by clinical measurement after moulding had disappeared. Thus, as may have been gathered, the figures given are based on radiographic pelvimetry but not upon radiographic cephalometry. They therefore do not represent true ante-natal prediction. Cases in which *all* the data have been obtained by radiological means are not yet sufficiently numerous to enable an adequate test to be made, but there is reason to suppose that when that number is gathered the results will not be substantially different from the sample now given.

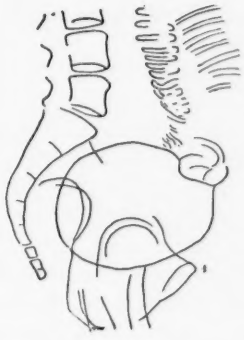

FIG. 11.

Tracing of a radiograph showing arrest of the head in labour in an occipito-posterior position. The uterus is braced back against the vertebral column causing the foetal trunk to be sharply angled (extended) on the head. In the unfavourable mechanical conditions thus created progress is arrested.

As a final comment on this method of reckoning the relationship of the foetal head to maternal pelvis let me again emphasize two points. This system of graphs enables the main obstetric features

to be quickly and easily evaluated, and in consequence it enables prognosis to be put on a much surer basis than is possible with "impressionistic" type of interpretation that has hitherto generally prevailed.

The Use of Radiology in Certain Special Conditions.

Brief mention will now be made of circumstances in which radiology has been found to be specially helpful.

High head at term and suspected pelvic contraction. This topic has been thoroughly discussed. Here I would add that it is no part of my mission to belittle the purely clinical methods of examination. It is on occasions when obstetric examination is difficult, or its findings equivocal, that resort must be had to radiology.

Abnormal or prolonged labour. Intrapartum radiology has in the past been surprisingly neglected. Not only will it help in diagnosing abnormalities of the foetus, malpresentations and the like, but, more particularly, it will often explain why progress is abnormal or delayed; and by showing whether or not the greatest diameter of the head has already passed through the contracted level of the pelvis it will give material help in deciding subsequent treatment in cases of trial labour.

Post-maturity and prematurity. In these conditions, cephalometry helps to establish the degree of development of the foetus. This, however, is a subject outside the scope of these lectures. The treatment of post-maturity largely depends on the size-relationship of head to pelvis, in the diagnosis of which radiography is undoubtedly helpful.

Breech presentation. When the head cannot be gauged directly against the pelvic brim as, for example, in breech presentation, there is special reason for radiological examination. Even a slight degree of disproportion may be a serious obstacle in breech delivery, for moulding has no time to develop, and a misfit, if present, does not become obvious until it is too late to avoid disaster. It is my firm opinion that every primigravida in whom a large, or even average-sized, foetus presents by the breech and version has failed, should have the benefit of careful pelvimetry and cephalometry.

Suspected hydrocephaly. In this condition radiology has an obvious use and may establish a diagnosis when clinical examination yields doubtful results. Nevertheless, caution must be observed in interpreting the radiograph, and in borderline cases the foetus must be given the benefit of any doubt. It should scarcely be necessary to point out that, when the head lies in some unusual position, special care must be taken to guard against radiographic distortion. I have experience of more than one case in which a foetus presenting by the breech has been wrongly diagnosed as hydrocephalic, sometimes with deplorable consequences. This has happened because the patient has been examined in the dorsal position: the foetal head then projects towards the X-ray tube and casts a shadow magnified out of proportion to that of the rest of the body (Plate XIII). With the technique described in the first lecture there is no possibility of such an obvious error.

Shall the patient be delivered at home or in hospital? In recent years there has been a decided change in the attitude of the public to maternity hospitals, and these institutions are more and more being asked to provide facilities for even normal confinements. The demand far outstrips the beds available. While this is so it is also true that examples are not far to seek of women being confined at home who, as events subsequently prove, are entirely unsuited for domiciliary delivery. It may be said that such events should never happen if ante-natal examination is adequate. This is true: but at the

present time it is the supply of adequate examiners that is lacking; and it is useless to pretend that this work can be done by anyone who holds a medical degree or nurse's diploma.

From what has been said it will be realised that radiology can differentiate between those patients in whom there is every reason to expect any easy spontaneous delivery and those in whom there is definite, or possible, risk of distocia from pelvi-foetal disproportion. A strong case can therefore be made out for routine radiological examination of every primigravida who is to be confined in her own home, especially if medical help is likely to be difficult to obtain. The routine radiological examination of the lungs of candidates entering the Services may in future have a counterpart in the routine radiological examination of patients entering their names for domiciliary delivery by municipal or district midwives.

Previous difficult labour. The death of a first baby is a heavy blow for a woman and the event will sometimes cloud the remainder of her life. After hard childbirth the question naturally arises whether misfortune will again befall the patient in a subsequent delivery. Not unreasonably, a delivery by Caesarean section is sometimes demanded, although on purely obstetrical grounds there may be no indication for the operation; indeed, experience shows that difficulty in a first labour is frequently caused by disordered uterine action rather than an abnormality of a recurring nature. When faced with these questions it is often difficult to make a decision. Radiological examination of the pelvis is then a boon, for the obstetrician is placed in a much better position to decide in advance the best line of treatment for his patient. In many cases the examination will result in a dispelling of anxieties that needlessly vex the woman's mind.

The fear of obstetric difficulty. Sometimes an unreasonable fear seizes a woman and she becomes obsessed with dismal forebodings. In these circumstances radiological examination gives extra weight to clinical examination and may be the means of allaying distress and restoring courage. An amusing example may be quoted.

A young, well-to-do lady consulted an obstetrician early in her pregnancy. She was told that her pelvis was small and that a Caesarean section would be necessary for the safe delivery of her child. She accepted the verdict and made arrangements accordingly. Meanwhile, air raids started and she was forced to leave her home, eventually reaching Oxford. My colleague, the late Dr. Sturrock, examined her but could find no evidence of pelvic contraction. As the patient was incredulous, he kindly referred her to me for further opinion. I also failed to find any contraction, but also equally failed to convince the patient, who, not unnaturally, had faith in the opinion of the first obstetrician to whom she had been specially recommended. I then made a radiological examination and found that the pelvis was not merely adequate in size but that it was actually one of the largest I had ever measured. This examination finally convinced the patient that Caesarean section was unnecessary, and I later had the satisfaction of learning that she was safely delivered after a normal labour lasting only a few hours.

Three Criticisms Answered.

Obstetrical radiology has been criticized because it emphasizes certain features of the birth process and ignores others that also play a highly important part in deciding the course of labour. This, of course, is perfectly true, and we must always be on guard against investing radiological reports with unreasonable importance. Nevertheless, disproportion in its widest sense is chief

among the causes of difficult childbirth, and here it is that radiology gives most help. If we trouble to take pelvic measurements at all we show our belief in their value. And, if we so believe, then surely it is right to strive for fuller knowledge and greater accuracy. I have not discussed uterine function, foetal position, mental fortitude and the rest, not because these matters lack importance but because they are not the subject of these lectures.

The fear is sometimes expressed that increased use of radiology will lead to increased and unnecessary surgical interference. This is possible when bad radiology is combined with bad obstetrics. But a similar fear might equally well be expressed when radiology is used as an aid to the diagnosis and treatment of fractured bones, of alimentary disorders, of pulmonary disease and so on. Yet radiology is accepted without question as a useful and even indispensable help in these conditions. Why, then, should we boggle at its use in obstetrics when so many of our problems are essentially mechanical in nature? The fear of needless surgical intervention has little foundation in fact. In my own experience radiology has oftener influenced me against Caesarean section than it has in favour of that operation.

It is further said that an increased use of radiology will lead to a weakening clinical judgment and that the radiologist will displace the obstetrician in deciding the manner in which delivery shall be conducted. This criticism again supposes that the obstetrician has no ability or clinical judgment of his own, and again in reply it may be said that if it is true that radiology has a stultifying influence in obstetrics, then it must have a like influence in other branches of medicine, as, for example, in the diagnosis and management of cases of pulmonary tuberculosis. In point of fact the fear is groundless. The obstetrician's clinical judgment is bettered, not worsened, by his increased knowledge and his clearer mental picture of the happenings in his patient's pelvis. And I trust that I am not expressing any disrespect for my radiological colleagues when I say that I do not suppose that they have any wish to be considered dispensers of judgment on the purely clinical aspects of obstetrics.

Finally, let no one suppose that radiology provides an easy short cut to good obstetrics. Only by sound clinical judgment can that end be reached. But sound judgment depends on the observation and appreciation of many diverse clinical features, and it is regarding one of the more important of these that radiology gives a keenness of perception unimagined by Ingleby and his generation.

ACKNOWLEDGMENT.

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Head Flexion in Forceps Technique

BY

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THE mechanical principles implicit in the design of the axis-traction forceps, the various forms of the female pelvis, and the different attitudes and positions of the foetal head, not infrequently supply problems which some of us find difficult to solve even with all the available knowledge applicable to technique. It is an essential part of successful forceps technique to apply the blades to the fully flexed head and to maintain this flexion until descent reaches the level where extension becomes the normal movement of delivery. In this connexion the words of Milne Murray are worth quoting: "We may consider," he writes, "the case of a normal pelvis where (for one reason or another) it is necessary to apply the instrument at the brim. Our object here is not to overcome special resistance so much as to apply a force in the appropriate direction so as to effect delivery with the least amount of that force. Our object then resolves itself into seizing the head in such a way as to develop and keep up flexion and to pull at all times in the proper axis." In the same paper he refers to the forceps as promoting flexion. It is true that the high forceps operation is not so frequently practised nowadays but it may still be the method of choice following the correction of certain malpositions. The same principles govern technique so long as the engaging diameter of the head is at any level above the obstetrical outlet and if they may sometimes lead us to a counsel of perfection which is some way removed from a similar perfection of achievement, the distance between these two ideals must always be the measure of our success.

This short paper attempts to illustrate certain aspects of flexion associated with vertex presentation which, although perhaps well known to most obstetricians, are not usually described in the textbooks, and which, while constituting some of the details of forceps technique difficult to attain in practice, at the same time comprise knowledge essential to the technician who constantly strives to perfect his own technique.

THE PROBLEM IN PRACTICE.

Most of the conditions which produce departure from the normal attitude of flexion of the head are described in the literature and need no recapitulation here. The occurrence of a median vertex presentation, the so-called military attitude, is not recognized by most authors, yet there are probably few experienced obstetricians who have not encountered it. The head sometimes lies in this attitude above the brim before labour begins and during labour, when uterine contractions are poor and the pelvic resistances slight, the deflexed attitude may remain undisturbed. In these circumstances such a head may descend in the transverse diameter of the pelvis and become arrested in the

transverse of the outlet forming a type of "deep transverse arrest," which, as De Lee points out, is scarcely to be distinguished from arrested rotation in occipito-posterior positions. In the presence of a powerful uterine force and normal pelvic resistances, flexion of the deflexed head is probably the rule.

The following case report provides interesting data.

Some time ago there was admitted into the Rankin Maternity Hospital a woman aged 40 years, in labour. She was full time, the onset of labour spontaneous, and her doctor stated she had been having pains for 48 hours. He had delivered her on 3 previous occasions and without difficulty. Her first infant born in 1926 weighed 14 pounds, her second in 1930, 12 pounds, her third in 1934, 7 pounds. She aborted at 4 months in 1942. During each of her labours she had been difficult to control owing to intolerance of pain. On this occasion her doctor had sent her into hospital because the head was still high and the patient herself almost maniacal. On examination she was found to be an Italian weighing over 20 stones. Abdominal palpation gave no information. The vagina was extremely capacious, and the whole hand could be easily introduced without causing her any discomfort. The cervix was fully dilated except for a small anterior rim. The head was still high, deflexed but with the occiput anterior. It was mobile and the impression gained was of a very roomy pelvis. There appeared to be no reason why delivery should not be spontaneous and non-descent was considered to be due to inadequacy of uterine force. A pad and binder were applied in the hope of promoting head flexion and assisting spontaneous expulsion. Morphia and scopolamine failed to reduce her vociferous response to pain and the Minnitt's apparatus was equally ineffective. After a few hours it became obvious that delivery would have to be assisted. The capacious vagina and roomy pelvis suggested that forceps delivery would not be difficult. The hand was introduced and full flexion of the head obtained before applying the blades. The blades were applied accurately to the sides of the head and traction begun. When traction-force had reached about 40 pounds the blades began to slip and were immediately removed. Examination found the head extended. Flexion was again obtained and the scalp over the occiput grasped with Willett's forceps. While an assistant maintained flexion by pulling on the Willett's instrument, the blades were re-applied. When traction force again reached about 40 pounds it became apparent that the head was becoming extended since the assistant was not able to maintain it in flexion against the more powerful movement of extension and the Willett's instrument tore free. At the same time the blades began to slip and were removed. Delivery was then accomplished by performing internal version and extracting as a breech. The foetus weighed 7 pounds 9 ounces and was stillborn.

Experimental Observations.

This failure to effect delivery with the forceps under circumstances which seemed to favour a safe and easy delivery was disturbing, and an early opportunity was taken to reproduce experimentally and as accurately as possible the conditions which had determined the result of this particular operation.

The head of a full-time foetus was fully flexed and fixed against very slight resistance with the occiput directly anterior. The blades of the forceps were applied along the occipito-mental diameter and traction begun. When traction-force reached about 40 pounds two things happened. Firstly the head became deflexed and secondly the forceps began to slip from the deflexed head. The deflexion of the head and the slipping of the blades really occur simultaneously, for the movement of extension raises the head from between the blades although slipping is scarcely appreciated until the head has become deflexed. Somewhat similar movements are occasionally seen when delivering the head through the vulva with the axis-traction instrument. If the rapidly-changing axis of the head is

not at the same time accompanied by a similar change in the direction of traction the blades slip from the extending head, sometimes even before the mouth and chin have cleared the perineum. In the experimental conditions it was found that by increasing the resistance to extension by narrowing the canal or by merely making pressure over the face, the traction-force necessary to effect it was raised.

Discussion.

Two important facts emerge from these observations:

1. The pull exerted on the axis-traction forceps tends to deflex the normally flexed fore-coming head.
2. Maintenance of flexion is a function of the maternal resistance in the conditions governing forceps extraction.

The movement of extension is prevented by the resistance of the birth canal and as the traction-force is raised the forces distending the canal are raised more or less proportionately and chiefly because of the tendency to increase of the diameter of engagement. A moment's reflection will show that this is inevitable. The foetal head moves at the atlanto-occipital joint and the old conception of this joint representing the fulcrum of a head lever with a long anterior and a short posterior arm gives an excellent mechanical representation. When the head is fully flexed the blades of the forceps grasp the long arm and their axis lies in front of the fulcrum so that deflexion of the head is the normal response to traction-force and can be prevented only by a sufficient resistance where the ends of the lever impinge on the walls of the canal. Figs. 1 and 2.

Experience with controlled axis traction suggests that the tendency to extension which is produced by traction-force is, in most cases, easily balanced by the counter-forces of the resistance with pulls up to about 50 pounds. As the traction-force is raised above this level the resistance finds it increasingly difficult to prevent extension, and the extent of laceration is often the measure of this difficulty. In this way we may be able to explain the difficulty and

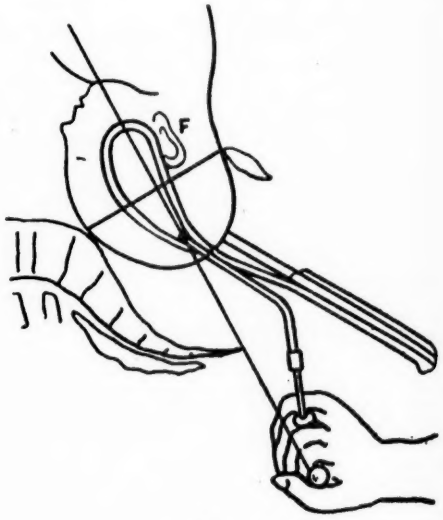

Fig. 1.

The head is fully flexed and the occipito-mental diameter coincides with the pelvic axis at the level of engagement. The blades have been applied along the occipito-mental diameter. With the fulcrum of the head lever at F, traction will tend to deflex the head.

laceration associated with forceps delivery in cases definitely without disproportion and in which the blades have been applied accurately to the head in flexion, since there is no other apparent reason why such cases should not be terminated by the use of force no greater than that of nature, and with no more injury to the soft parts than is commonly observed after spontaneous expulsion.

When the head is fully flexed, the occipito-mental diameter coincides approximately with the pelvic axis at any level from brim to pelvic floor. It follows that if the blades of the forceps are placed along this diameter as they should be in these circumstances, the direction of traction will be in the axis of the birth canal. If, however, the head deviates from full flexion, the ideal application of the blades along the occipito-mental diameter will not promote flexion but will tend to increase deflexion when traction is begun, nor will traction-force itself be directed in the pelvic axis. When the head is deflexed, application of the blades over the ears, so that the long axis of each blade lies just in front of the tragus, while the tip reaches over the angle of the jaw, will allow traction in the pelvic axis but will also tend to increase extension when traction is begun. (Figs. 1 and 2).

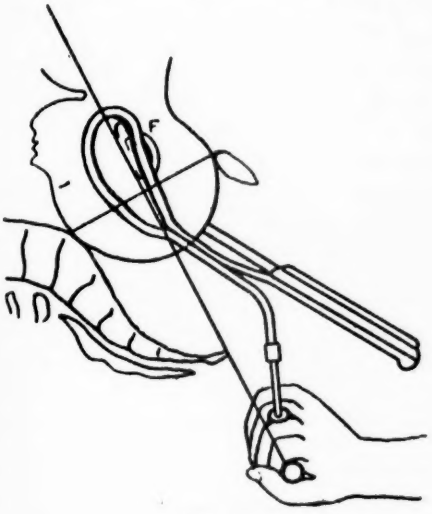

FIG. 2.

The head is deflexed. The occipito-mental diameter deviates from the pelvic axis. The blades have been applied in the pelvic axis. With the fulcrum of the head lever at F traction will tend to increase extension.

It is easy enough to demonstrate the great importance of full flexion of the head in forceps technique but it is not so easy to suggest a means of obtaining and maintaining it in cases where it is wanting. As has been suggested in the case described above, the Willett's instrument is worse than useless for this purpose since it will only result in laceration of the scalp. When uterine contractions are frequent, traction-force may be made to coincide with them while at the same time fundal pressure may be useful. In this way advantage is taken of the normal flexing effects of the natural forces. It has been pointed out above that a pull greater than 50 pounds tends to increase the engaging diameter and to put the soft parts under a tension which rapidly approaches rupture as the force is raised above this. Much trouble may, therefore, be avoided by the patient development of a rhythmic traction-force up to 50 pounds, coincident with uterine contractions and, when greater force is necessary, by "stepping up" the pull slowly and gradually. It is fortunate that most cases can be delivered with a pull no greater than 50 pounds, since a greater force can only increase the difficulty of extraction and although this is eventually achieved, it is usually at the expense of the soft parts.

The late Joseph De Lee was well aware of the great difficulty of obtaining an accurate technique with the axis-traction forceps, and he strongly condemned the use of this instrument. He, himself, in the matter of forceps technique, was a disciple of Pajot. "By means of Pajot's manoeuvre," he writes, "we can give the head a direction which a knowledge of the mechanism of labour will indicate: by careful observance of the tendencies of movements which the forces of nature give the head, we can determine in which way to apply traction, and we can aid one or other as

required." By contrast, he states, one can only pull blindly on the Milne-Murray instrument. Despite this criticism from so great a master of obstetrical technique, there can be little doubt that the axis-traction forceps is capable of great accuracy and when it fails to achieve this the fault lies, not with instrument, but with the operator. This accuracy would be increased and the operation rendered safer if some means could be devised to maintain head flexion during traction and so ensure the engagement of the smallest possible diameter of the head in its passage through the pelvis. In this way the maternal tissues would be spared a strain which nature never intended they should support.

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A Preliminary Report on the Pelvic Brim Index

BY

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PART I. GENERAL.*

A. *Introductory Note.*

THE purpose of this communication is to report pelvic brim index values derived from series of South African Negro or Bantu pelves, and at the same time to discuss the variation of the index figures in different races and in the same race under different conditions.

The index is of value because, in considering the pelvis in its simplest form as a girdle, the obstetrician is immediately satisfied, and the anatomist accepts the plane under consideration because it is defined by the iliopectineal line. In its non-pathological form this girdle is invariably rounded or well curved laterally, and the index gives a good practical impression of its shape, viz. whether it is round, transversely oval, or oval in the sagittal plane.

The index is of interest for two reasons in the first place. These are based on two characteristics of the index that have been recently discovered. First, it appears that under favourable, healthy living conditions the index—even in the same district—can be higher than is found in circumstances of poverty. Secondly, the pelvis most favourable to spontaneous labour has proved to be the one which is oval anteroposteriorly (index over 100). In addition to this, it has been shown (Heyns, 1946a) that the evolutionary purpose in man is to produce the "anthropoid type" pelvis with index over 100. In accordance with Bolk's hypothesis (1925–26), the retardation of the factors leading to pelvic maturity is sufficiently effective to leave the stamp of foetalization on the majority of adult pelves: only a minority excel, become phylogenetically more highly evolved, and are in fact more efficient as ultra-dolichopellic pelves. The latter have larger inlets, presumably because ilium and pubis grow inordinately at the Y-shaped epiphysis; and it is possible that in such pelves the inlet plane has a relatively greater area because less active growth in this region would simply have resulted in the smaller area of a round or flattened brim. The causes of this hypothetical greater acetabular than symphyseal growth have to be discovered, and herein lies the significance of this simple index, for it is a good criterion of pelvic development and growth. The pelvis, apart from the girdle proper, is of minor interest to the obstetrician and possibly even to the anatomist.

B. *The brim index in different races.*

So many figures have been published on this important pelvic index, and as in Turner's paper (1886) so many races providing only a few specimens have had their respective indices put on record, that it is of value to possess Bantu figures derived

* Part I of this paper originates from a D.Sc. Thesis, University of the Witwatersrand.

from a reasonable series. The mode of life of the Bantu is significantly different from that of the European, and dissecting room specimens need not be considered to be selected from any particular social stratum as tends to be the case with the European. For Europeans alone, Martin (1928) and Turner (1886) collected figures for both sexes from 7 authors, of whom 3 found a higher index for the female and 4 a higher index for the male.

In the English literature the pelvic brim index is known as the index of Turner (1886) who himself, however, explains how Zaayer (1866) came to be the first to use this valuable numerical expression. The findings for Bantu skeletal material were as follows:

Series	Mean	S.D.	Range		Significance: Difference of means ÷ Standard error of means	
65 Female	90.35 ± 1.02	8.20	69.6 –	104.4		
50 Bantu	92.80 ± 1.34	9.47	70.2 –	117.0	1.17	0.88
50 Zulu	91.08 ± 1.17	8.24	75.5 –	110.0		
100 Male	91.56 ± 0.91	9.11	70.2 –	117.0		

The index values in 100 Bantu primigravidae ranged between 79.7 and 121.2, the mean being 93.6 ± 0.72 and standard deviation 7.2. The number (i.e. percentage) of indices 100 or over was 17, which corresponds closely with the figures for the skeletal material of both sexes. These measurements were gained radiographically with the brim parallel to the film. In a second series of 25 non-pregnant women X-rayed by Nicholson's (1936) stereometric technique, the mean was 91.27. The application of this index in X-ray pelvimetry is discussed elsewhere (Heyns, 1946 b).

It can now be said that the Bantu male has an index comparable with that of the female, and that there is no significant difference whatsoever between the sexes; that the index is over 90, and that it is, therefore, mesatipellic in Turner's (1886) sense.

The female Bush pelvis gave a brim index of 105.2, the 4 pelves studied by Orford having an index of 99, 112.6, 97.3, and 112 respectively. The male Bush pelvis has the high brim index of 97.7, ranging in 9 pelves between 88.6 and 105.5 (Orford, 1934). Slome (1929) found the average index for 2 female Bush pelves to be 99.7 and for 5 male pelves 89.2. When Turner wrote in 1886, 8 female Bush pelves and 5 male had been measured by different authors. The females showed an average index of 89, which suggests that the true mean is lower than Orford's high figure of 105.2; and the males an index of 99.5. The male indices ranged from 93 in Fritsch's (1872) specimen to 109 in Turner's. Thus the total of 19 male pelves give a dolichopellic index, or one over 95. The females appear to have a lower index.

It is important now to consider whether a flattened or rounded brim is to be expected under favourable living conditions, and what is the evidence for the belief that the European trend is in the direction of the round brim with index near to 100 (Thoms, 1941; Ince and Young, 1940; Nicholson, 1945).

Authors of last century found strikingly low indices. Thus Turner (1886) and Verneau (1875) amongst others found average indices below 80 for the higher races. In many cases small series of under 20 specimens were reported on, and Verneau

himself studied biometrically only 35 females and 63 males amongst European pelves. It is difficult to account for these low indices, even if different measurements were employed for conjugate and transverse diameters which, in the majority of cases, have termini that are well marked on the bones.

For a living racial group, one of the lowest indices found was the value (81.8) derived from Pan's figures (1929) for 64 Hindu females. By comparison, only 16 of the 100 male Bantu pelves had an index below 82. An index of 80 or 81 to-day as an average for white races seems extremely unlikely, though it has to be confessed that this opinion rests on the precarious information derived from radiography. Nicholson (1938) found a mean of 88.3 for the brim index in 350 rural English women, and Ince and Young (1940) a mean index of 90.8 in 509 London women. Thoms (1941) who consistently fails to report averages for the indices of which he frequently publishes other analyses finds that the great majority of his American subjects have an index of over 90, and that a minority are platypellic. Greulich and Thoms (1939) have even brought evidence to suggest that a group of 104 nulliparous students of superior economic and physical status has a mean index which is dolichopellic. In the light of this evidence, and from findings in the Bantu—and even in the dolichopellic Bush race—the prevailing belief that the platypellic type of brim is characteristic for the female is not well founded. Jarcho (1933) believes that the round or dolichopellic type of pelvis is found in the aborigines of America, Australia, and the East Indies; and at the other end of the scale there is the view (Stoney, 1930; Vaughan, 1937) that platypellic pelves are less the result of racial influence than of the conditions of life in modern civilization.

In his stimulating paper Derry (1923) bases some conclusions on his pelvic chilotic line which corresponds with that portion of the iliopectineal line extending from its anterior extremity on the ilium to the sacro-iliac joint. It was found that females of the Sixth to Twelfth Dynasties possessed pelves with the greatest antero-posterior diameter. English hip-bones from Whitechapel indicated smaller pelves in this respect than even the Predynastic and Kerma (Nubian) innominate bones studied. The English material was thought to be less typically female than is the case in Egyptian women generally, and even less so when compared with the women of the Sixth to Twelfth Dynasties. Because the Predynastic and Kerma female material was less differentiated from the male than was the case with the corresponding higher English and Old Empire groups, Derry sees confirmation of the view that there is less sex differentiation in primitive than in higher races. Kenny's findings (1944) show how correct was Derry's conclusion that a large antero-posterior diameter is of greater importance for an easy labour than a large transverse.

Two interesting racial groups are the Veddahs of Ceylon and the Indians of Pecos Pueblo. While the former gave an index (Hill, 1941) of 91.9 (13 males) and 91.2 (7 females), the corresponding Indian figure was below 74 in all female groups (Hooton, 1930). The Pecos Indians subsisted chiefly on maize, and there is evidence that the health of the inhabitants declined during the closing periods of the settlement. Nevertheless, the female brim index was 70.5 in the two earliest periods, and the male remained approximately the same throughout (mean 76.1). These pelves were extremely wide, both at the brim and the iliac crest, as compared with the Bantu, and the brim calculated mean area of 95.5 sq. cm. compares with the

corresponding female Bantu figure of 101.2 sq. cm. The Pecos area is similar to Pan's (1929) for the female Hindu (95.1 sq cm.), yet the latter has a brim transverse of the same order as the Bantu female. The Pecos superior strait is, therefore, much flatter than that of the Hindu which in turn is considerably flatter than that in the Twentieth-Century Bantu, English, or American white female. The Veddahs show an index equal to that of the last three groups. This Ceylon race availed itself of a range of food which is almost unequalled, an exception being the absence of milk. Hill (1941) states that water was the only drink known to these people. As milk is the only rich source of calcium, it is difficult to understand how in the Veddah rickets is avoided during childhood, and consequently a flat pelvis. In many hundreds of human pelves studied, the non-rickety platypelloid pelvis of Caldwell and Moloy occurs in only 1 or 2 per cent (Caldwell and Moloy, 1933; Heyns, 1944; Kenny, 1944, etc.). There is no doubt that development of the pelvic brim during childhood and adolescence must be studied with greater precision before the factors influencing pelvic shape will emerge. The alternative view that the morphology of the brim is due to racial factors is as unsatisfactory as postulating nutritional causes in all those cases which do not exhibit frank rachitic pathology.

Finally, the influence of sacral breadth on the brim index must be considered. The Veddah sacral index was dolicho-hieric in the male and only 100.7 in the female. Such a narrow sacrum is unusual, but has the effect of decreasing the brim transverse diameter and accordingly raising the brim index. Conversely, the female Pecos sacral index was very high at 114.3—male index 111.2—and the sacral breadth was 114.34 mm. in 47 females and 115.8 mm. in 66 females, as against a figure of 106.6 mm. in the Bantu female. It is evident that the sacrum must be partly responsible for the low Pecos brim index. It is submitted, therefore, that the sacral breadth should always be shown with the brim index.

C. *Ontogeny and phylogeny.*

(*a*) *General.*

In the foetus the brim index has been found to be over 100 just as frequently as in the adult. Thus in the Bantu 17 of 100 foetuses had an index over 100, none being exactly 100. Of Fehling's (1876) 130 foetuses available for this analysis, 12.3 per cent had an index of 100 or more. Kappers (1938) found only 2 brim indices over 100 in 53 foetal pelves. No significant sexual differentiation was found except by Fehling (1876) who was unable, however, to substantiate his claim in this respect.

In the postnatal years the brim becomes round and even ultra-dolichopellic (see Fig. F12). In the measurement of dry pelves, as Kappers (1938) pointed out, shrinkage with distortion is most marked up to the age of 7 years, and the result of this is an increase in the conjugate and a decrease in the transverse diameter. But in formalin-preserved and fresh specimens the preponderance of conjugate over transverse is still pronounced, and even after the tenth year this ratio holds. In spite of the arguments surrounding this problem, therefore, the index is in all probability higher during childhood than during the foetal period.

Veit (1883) found in 50 neonatal pelves that the ratio of conjugate to transverse was as 1 is to 1.093, thus showing no change from foetal mesatipelly. Only 3 of his own 27 pelves had an index over 100. Merkel (1903) observed an increase in the conjugate during infancy as had Kehrer (1873) before him, and Jürgens (1891) with his valuable series totalling 43.

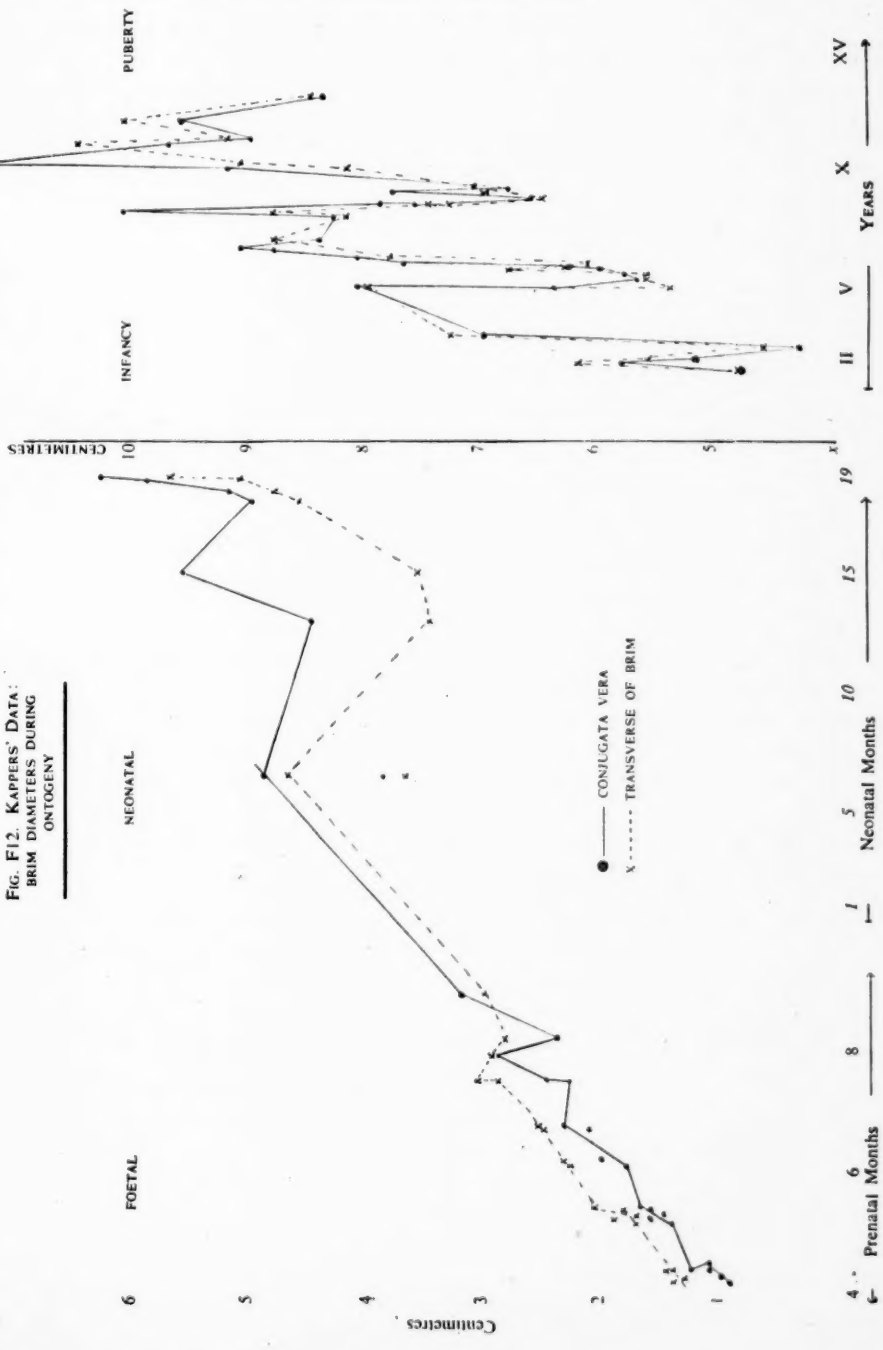

FIG. F12. KAPPERS' DATA: BRIM DIAMETERS DURING ONTOGENY

Hennig (1880) measured 5 female pelves (aged 6 months to 8 years) of which the inlets were round, and made a remark about the 8-years old pelvis that it was round while *in situ* in the fresh cadaver. A female pelvis aged 10 years was dolichopellic and Hennig states that the index is higher in children than in neonatals. In Turquet's series (1884) of 70 infantile pelves, the sagittal was equal to or greater than the transverse in 28.5 per cent. He mentions as a cause of this finding tuberculosis and syphilis, diseases to which these infants succumbed!

Breus and Kolisko (1904) state that the transverse diameter becomes less than the antero-posterior from 8 to 11 years. "It should be observed," says Kappers (1938), "that this surely cannot be regarded as unusual, when even before the 8th year a similar ratio is found." Breus and Kolisko suggest that from 8 to 11 years sacral growth is arrested with the accompaniment of a more rapid tempo in ilium growth. After this age-period, growth of the sacral breadth gains momentum and exceeds that of the ilium. But these authors measured very small numbers of children's pelves, and of these only a small proportion were young ones.

A consideration of the later phases of ontogenetic development of the pelvis must include reference to Ssoson-Jaroschewitz (1925) who studied a large collection of skeletal material. Of 150 adults over the age of 25, 13.3 per cent had an index of over 100; of 108 pelves of all ages up to 25 years, 39.1 per cent had indices over 100. The Bantu females of the present series had 13.4 per cent of anthropoid pelves (Caldwell and Moloy classification, 1933) in which the brim index is usually over 100; and of the 100 males 16 were anthropoid. This corresponds well with the Russian findings of Ssoson-Jaroschewitz (1925) and even with the 215 American (11.6 per cent) classified by Caldwell and Moloy (1934). It is submitted that 12 per cent of the pelves of a given population can be expected to be anthropoid, and Kappers' criticism (1938) of the Russian results is not well substantiated. The fact that emerges from the Russian material, however, is that childhood shows more high indices than the adult stage.

Summarizing the position, it may be said that (1) the foetal pelvis tends to be platypellic with, towards the end of intrauterine life, occasional examples of mesati- and dolichopelly; (2) during infancy and childhood up to the age of 13 years the brim is mesatipellic: while dolichopelly is normal and common, platypelly is now rare; and (3) after 13 years and during the adult stage the pelvis again tends towards platypelly. At no period can any sexual differentiation be based on the pelvic brim index.

A phylogenetic survey shows (Schumann, 1915) that at the gorilla stage the contour of the pelvic inlet is oval, the antero-posterior diameter still being greater than the transverse, though the proportion is much more nearly equal than in any lower species. In the kangaroo the pelvic brim has the shape of a narrow triangle. The triangular form becomes progressively widened as the scale is ascended until, the sides becoming more and more concave, the brim becomes ovoid in the ungulates. In all quadrupeds the antero-posterior is greater than the transverse diameter. The infantile pelvis, then, more nearly approximates the quadruped type, and is not dissimilar to that of the highest apes.

In mammals, from the monotremata right up to the primates, there is extension of the head on the trunk during parturition (Schumann, 1915); but in anthropoid apes and man the facial angle rises above 45 degrees, and flexion of the head during birth becomes the ideal.

(*b*) *Bantu data.*

An ontogenetic survey of the Bantu pelvic brim has been published elsewhere (Heyns, 1946), and demonstrates the following facts.

(1) Seventeen of 100 foetuses had an index over 100 (or 100 and over); 33 per per cent were dolichopellic (index over 95).

(2) In 39 children aged 1 to 15 years, 15.4 per cent have indices over 100 and are of well-marked anthropoid type. But 35.9 per cent (14 pelves) have an index of 100 or more.

(3) (*a*) In 45 adolescent females aged 15 to 19 years, 13.3 per cent had indices of 100 or 100 and over, and 28.9 per cent were dolichopellic.

(*b*) Of 31 females aged 20 to 25 years, 19.3 per cent had indices of 100 or more, and by some chance 48.4 per cent were dolichopellic.

(*c*) For adult indices of 100 or over, there were 17 of 100 male dry pelves, 12 per cent of 67 female dry pelves, 17 of 100 female X-rayed subjects, and 20 per cent of another series of 25 X-rayed women. The dry pelves exhibited the Caldwell and Moloy anthropoid type in 13.4 per cent of females and 16 per cent of males, both figures being very close to those given above (12 and 17 respectively).

Concerning the foetal brims mentioned under (1) above, the index reached 110 on only two occasions, and the brims never resembled the pronounced "anthropoid type" seen in the adult: they certainly do not approach the relative proportions of the ape brim. These high-index foetal brims are in fact only round, or "more round" than the average brim.

The infant and child pelvis moves further in the direction of "roundness" than the foetal with a percentage difference which is 2.23 times its standard error. Now for the first time do outspoken "anthropoid types" appear—but the outstanding observation concerning the infant brim is the trend from flatness to roundness.

The percentage difference of indices 100 or over between the 1 to 15 and 15 to 19 year age groups is 2.5 times its standard error, and is probably significant. It is seen, therefore, that from infancy to puberty or thereabouts pelves are significantly less flat than those in the foetus on the one hand and those in the adolescent on the other. The figures for this adolescent period show no significant difference from the total figures for the age period 15 to 25 years; nor do the figures for the 15 to 25 year period differ significantly from the corresponding figures for the adult skeletal material.

The difference in the incidence of dolichopelly in the 15 to 19 and 20 to 25 year age groups is only 1.7 times its standard error, and is not significant. Similarly, the difference in the dolichopellic incidence between the foetal and the 20 to 25 year groups is only 1.5 times its standard error. Adult and foetal incidence of this character correspond closely, being respectively 34.5 and 33 per cent; and the adult dolichopellic incidence is equally similar to that of the 15 to 25 year age group.

In the adult there occurs on the average a flatter pelvis than in the child. The "anthropoid type" incidence is still equal to that in the foetus, though the "anthropoid" appearance reaches greater emphasis in the specimens so characterized. Something happens at pubertal age to arrest the development of round or ultra-dolichopellic brims, but the basis of this is not evolution (Heyns, 1946). The cause may be some combination of factors concerned with sex hormones, the influence of nutrition on metabolism, and physical forces based on weight-bearing and progression.

PART II.

ANALYSIS OF ANATOMICAL OBSERVATIONS.

A. *Testing of the validity of certain current hypotheses.*

1. Nicholson (1945), in an attempt to place the conjugata vera in the forefront of the picture, has drawn attention to the fact that the coefficient of variation of the transverse diameter is 5.8 per cent as against 7.8 for the conjugate. It is difficult to see how he reaches the conclusion from this that pelvic capacity tends to be a function of the conjugate diameter only. In 100 Bantu dry male pelves the coefficient figures were 7.1 per cent (transverse), and 10.2 per cent (conjugate); in 66 Bantu dry female pelves the corresponding figures were 6.5 and 7.6; and in 100 pregnant Bantu 6.9 and 7.7.

2. How close is the relationship between brim index and brim area? In other words, can all brims with index over 100 be expected to have a large area and vice versa? While it seems likely that this is the case, important exceptions have been found in the Bantu, and on clinical grounds these fall in the small category of pelves which *per se* cause dystocia. Thus in 125 Bantu women X-rayed—100 unselected consecutive primigravidae and 25 parous women who had sustained vesico-vaginal fistula—there were 4 pelves, 2 from each group, that had the cavity plane area below 80 sq. cm. The brim indices ranged from 102.1 to 109.3. The mean of this cavity area for the 100 primigravidae was 93.75 sq. cm. Thus about 3 per cent of the pelves were anthropoid types with greatly contracted girdles.

The coefficient of correlation between brim index and brim area in 100 Bantu dry male pelves was $+0.256 \pm 0.1004$. As $r = 2.56$ times its standard error, the relationship is only possibly significant. The correlation coefficient in 51 Bantu dry female pelves was $+0.798 \pm 0.141$ which is 0.57 times the standard error. In the latter instance the value of r has no significance, and bears out statistically what was suspected from the data derived from the clinical material mentioned above.

3. A third point, concerning antero-posterior flattening of the brim, needs clarification, though the evidence available is insufficient for a final solution of this aspect of the problem. If the perimeter of the brim is c cm. and the area enclosed by the brim when circular in shape is a sq. cm., then any compression of the brim causing a flat shape which is no longer a circle would result in a brim area which is less than a sq. cm. The circumference of the flattened circle would still be c cm. Whether this flattening process ever enters into the matter of brim development must now be considered.

Imagine an adult pelvis with round brim. In the early stages of osteomalacia the brim may become compressed antero-posteriorly, and there would be a loss of area. Whether rickets acts in this manner is not so easily determined. It is possible that, in addition to flattening during infancy and childhood, there is a measure of arrest of pelvic growth at the brim. Such an arrest may affect both the sacrum and the epiphyses related to the brim, or only some of the epiphyses. It is necessary to bear in mind that at the age of 3 or 4 years the pelvic girdle is quite small, and that such an increase in its perimeter occurs after this age that the girdle becomes 3 to 4 times as large in area during adolescence as it was during infancy.

If the antero-posterior compression occurring in the presence of rickets is applied to a fully, or nearly fully, developed pelvis, the abnormal bending of the bone may occur anteriorly in the region of the superior ramus of the pubis or posteriorly in relation to the iliac portion of the ilio-pectineal line. If the latter were

to occur, shortening of the conjugate diameter might well be associated with increase in the transverse diameter of the brim. Nicholson (1945) refers to this and states: "in the true rachitic pelvis there is undoubtedly a shortening of the conjugate diameter associated with a lengthening of the transverse, and it is a common fallacy that this strong negative correlation persists in the healthy pelvis." When he goes on to say that "it is obvious that this false reasoning can lead to some absurd conclusions," one is in sympathy with him. But the matter is not quite obvious, and any statistical predictions must be checked experimentally, which here amounts to precise clinical observation.

It would be of great value if workers in an industrial area where rickets is rife were to make X-ray studies of pelves showing unequivocal rickets. The necessary evidence is not available at present. In the Bantu, rickets, though common, is not often seen in severe form. Whether flat Bantu pelves with low brim indices were rickety could not be determined even when skeletal material was studied. It is possible that a rachitic pathology was the basis for flatness in these specimens, except in the cases where Caldwell and Moloy's platypelloid type was diagnosed.

(*a*) There is no doubt that there must be a very high correlation between the anterior straight breadth of the sacrum and the greatest transverse diameter of the brim. It was pointed out in connexion with the Veddah and Pecos brims that sacral width played a major rôle in influencing the brim index. Against the brim index we may, therefore, consider the conjugate-sacral index which has conjugata vera as numerator and sacral width as denominator. This index should show a high relationship with the brim index. In 100 male dry pelves $r = +0.804 \pm 0.1$, r thus being 8 times its standard error and consequently highly significant. In 61 female dry pelves $r = +0.813 \pm 0.109$, r being 7.47 times its standard error. This relationship shows that the transverse diameter is to a great extent determined by sacral width. To what extent sacral growth is influenced by rickets is not known, but it is obvious that a knowledge of this is requisite to an understanding of the effect of rickets on brim shape.

Fig. 1 shows how closely the brim index follows the conjugate-sacral index in 61 dry female Bantu pelves.

(*b*) The difference between the Bantu means of the brim transverse diameter and of sacral breadth is as follows: in 100 male dry pelves 8.2 mm., and in 66 female dry pelves 13 mm. The coefficients of variation were respectively 7.1 and 6.8 per cent for the male diameters, and 6.5 and 6 per cent in the females. It was found that the mean sacral width was greater in the female than the male by 2.2 mm., the difference being only 2.12 times its standard error and thus only possibly significant. The transverse diameter of the brim showed a highly significant sexual difference of 7 mm. which was 5.65 times its standard error. In order to discover whether low brim index pelves, in the hypothetical flattening process due to rickets, exhibited an increase in the transverse diameter of the brim, a simple graph was made (Fig. 2). Only differences of 15 mm. and more between sacral width and transverse diameter were recorded for this purpose. It is easily seen that if antero-posterior shortening of diameters in rickets is associated with bulging out at the iliac portion of the ilio-pectineal line, then the difference between transverse diameter and sacral breadth must be greater than in the non-rachitic pelvis. The rachitic pelvis, by virtue of becoming flattened, has a low brim index and, therefore, if rickets causes this increase in the transverse that Nicholson

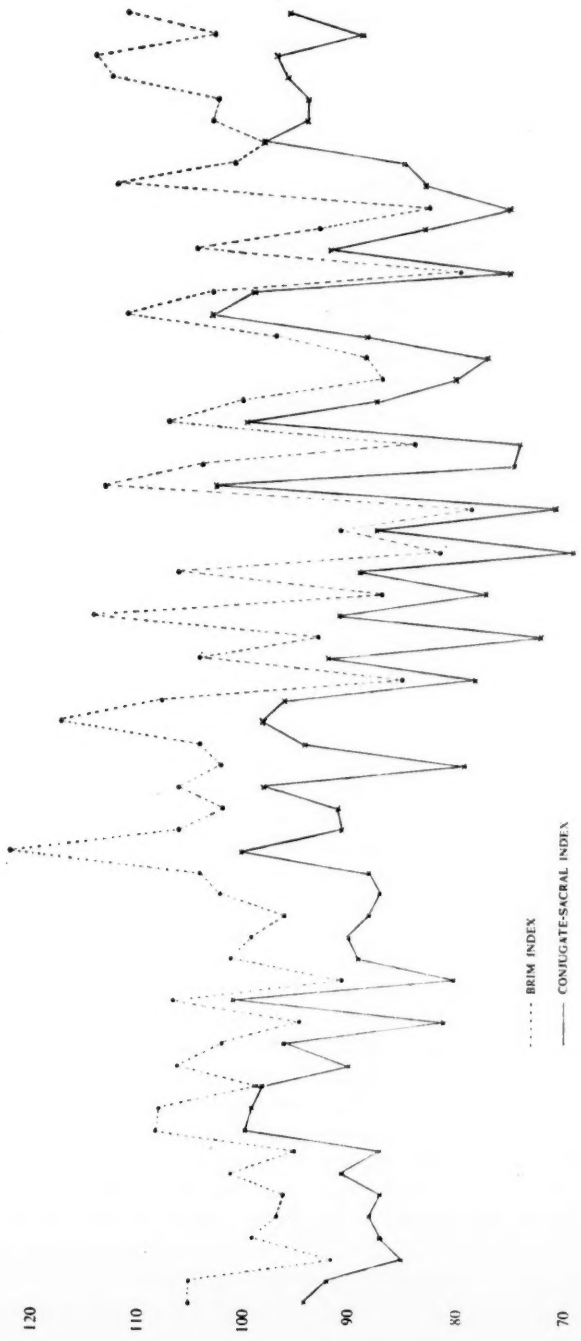

FIG. 1

claims, low brim indices should be found associated with great differences between brim and sacral width. The graphs in Fig. 2 show that this is by no means the case.

It will be observed that only 16 of 100 males have the brim-transverse-sacral breadth difference 15 mm. or more, whereas 24 or 36.4 per cent of females show such a difference. It would be invalid to ascribe the greater lateral bulge of the iliac portion of the brim in the female to rickets, because there is no evidence to show that rickets affects the female pelvis more than the male. This greater bulge is a sexual character. The sexual difference in the percentage incidence of the greater bulge is significant, being 3.3 times its standard error.

In the female series of 65 pelves the mean brim index was 90.35 and the mean index for the 24 female pelves shown in Fig 2 is 88.6. The difference is not significant, it being just less than its standard error. In the male series of 100 pelves the brim index was 91.56, and the 16 male pelves of Fig. 2 have a mean index of 85.9. The standard error of the difference between the two male means is 4, and this difference is accordingly not significant. Thus brim indices should not be expected to be lower in those pelves with a pronounced difference between the transverse diameter of the brim and the breadth of the sacrum than in those with a small corresponding difference. It must, therefore, be admitted that pelves exhibiting a moderate degree of rickets do not possess a marked difference between brim transverse and sacral breadth, for rachitic pelves tend to have a low brim index value; and here it is seen that the pronounced differences occur in association with brim indices that do not differ significantly from those of the total series in both sexes.

It may be contended that the Bantu pelves used for the above argument were not subjected to rachitic influences. If that is so, then Nicholson's point about the absence of a strong negative correlation between conjugate and transverse diameters in the healthy pelvis has been proved adequately. It still remains to be proved, in that case, that this negative correlation exists in frankly rachitic pelves. To the student of the ontogenetic development of the pelvis, gross deformities of the girdle due to rickets are of negligible interest because these are observed in only a few localities; but the unobtrusive effects of rickets must be observed and analyzed because of the belief that in non-industrial European communities development of the pelvis in the unequivocal absence of rickets is possibly as rare as the incidence of gross rickets. The above analysis leads to the conclusion that flattening of the brim in rickets, so far as the limits of the ilio-pectineal line are concerned, is probably confined to a bending at the brim of the pubes rather than the ilia.

B. *Factors influencing the brim index.*

What are the anatomical factors that influence the brim index? These factors appear to be as follows:

I. Growth of bone at certain epiphyses:

(*a*) Acetabular epiphyses, but more directly the anterior limb of the Y-shaped epiphysis.

(*b*) Epiphyses at the symphysis pubis.

(*c*) Sacral epiphyses concerned with growth in width in the region of the sacro-iliac joint.

II. Development of the sacral alae causing greater anterior curvature of the sacrum, and thus a pushing of the sacrum posterior or the rest of the girdle anterior.

III. (*a*) Bending, possibly due to rickets, of the bony girdle at the iliac portion of the ilio-pectineal line. This will increase the length of the greatest transverse diameter of the brim.

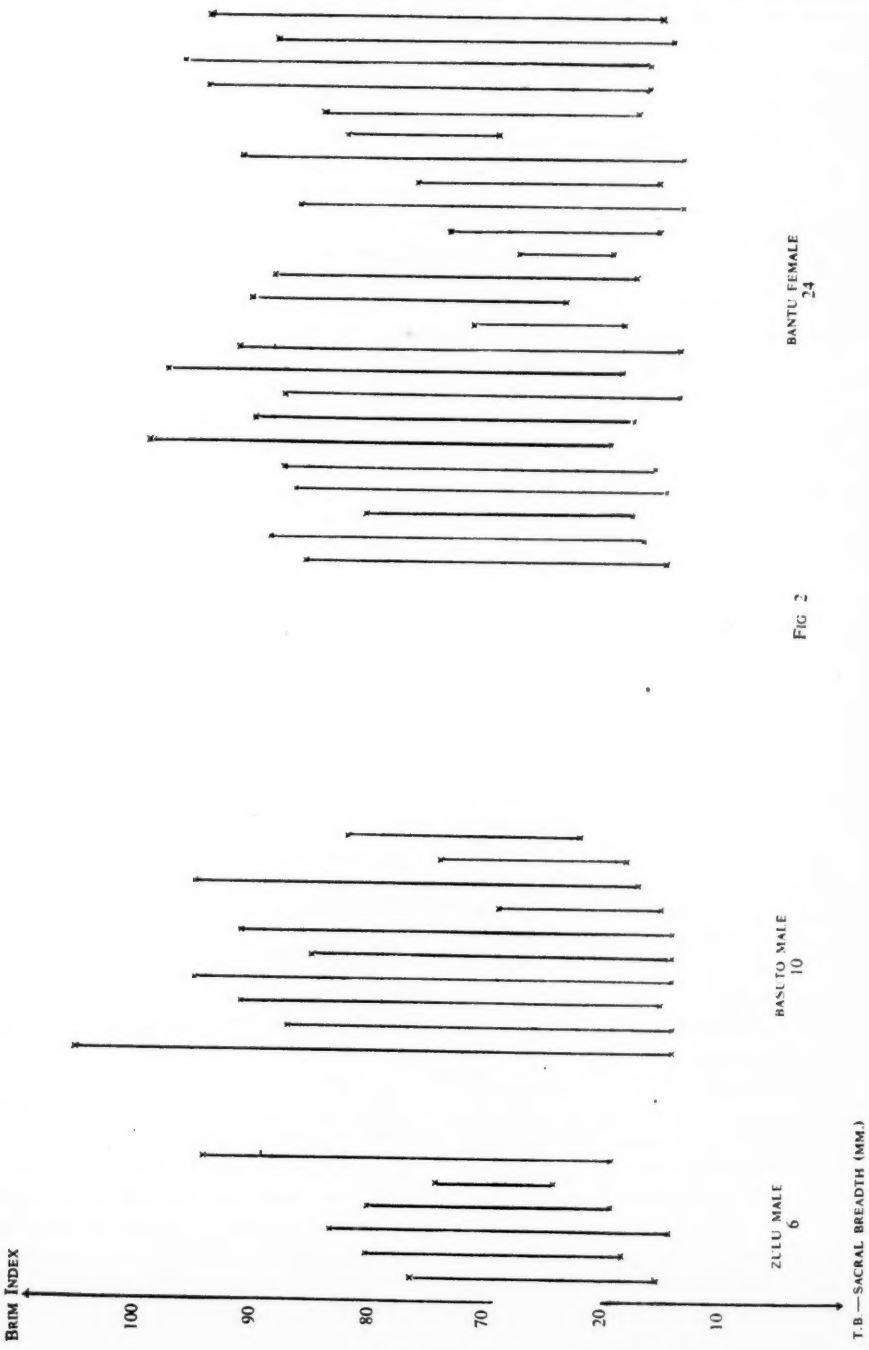
BANTU FEMALE
24
BASUTO MALE
10
ZULU MALE
6
BRIM INDEX
100
90
80
70
20
10
T.B — SACRAL BREADTH (MM.)

FIG 2

(*b*) Wherever the bending of bone mentioned in III(*a*) occurs as the result of an antero-posterior force, the conjugate diameter will be diminished.

IV. The tendency of the sacral promontory to be situated forward, i.e. near to the greatest transverse diameter, in pelves of the android type.

IA. *Bone growth at epiphysial cartilages.*

1. *Mechanism.*

If a little thought is given to the manner in which the pelvic girdle increases in size, it will be realized:

(i) That increase in antero-posterior length can only occur appreciably as the result of growth at the anterior limb of the Y-shaped acetabular epiphyses on either side.

(ii) That increase in transverse width may occur by growth either at the sacrum or at the epiphyses in relation to the symphyseal face of the pubis on either side. That the latter growth is possible no one will deny, but that growth at the symphysis is considerable will be shown to be highly probable. In this connexion reference must be made to the work of Todd (1921–23) who has traced phyligenetically the fate of the symphyseal median bar with its upper and lower nodules. This is the typical Eutherian arrangement at the symphysis pubis. Todd's observations both in Eutheria and in his extensive human material lead to the conviction that growth activity at the symphysis pubis is pronounced and, in fact, that changes in the face and certain parts in close relation to it continue right into the fifth decade of life. There can be no hesitation in agreeing with him that "the epiphysial remnants of the human symphysis, namely ventral rampart, upper extremity and to a less and more variable extent the lower extremity are the homologues of median bar and upper and lower nodules of typically Eutherian metamorphosis."

The fact that the brim index shows a pronounced tendency, from the time the infant walks, to reach values of 100 and more suggests that weight-bearing and increased mechanical stimulation of the acetabular epiphyses are associated with augmented proliferation of cells of the Y-shaped epiphysis. From Bantu data of the brim area in children (radiographic) and foetuses a calculation, on a three-dimensional basis, shows relative growth activity to occur as shown in Table I. It may be taken broadly that the 3-months-old foetus has a brim area of 0.5 sq. cm., the newborn area being 10 sq. cm., that at 2 years it is 20 sq. cm., at 8 years 50 sq. cm., and at 14 years 80 sq. cm.

The values for the different ontogenetic periods give a measure of the relative increase of bone volume during the periods under review. The active proliferation of cells during the foetal period is followed by considerable slowing down until the infant is 2 or 3 years old; after this age the individual years show a pronounced drop in activity so that the relative increase from 2 to 8 years is about one-third of the infancy period; and finally, from 8 to 14 years the rate of growth is 56 per cent of that in the previous 6 years.

2. *Increase of brim axes during ontogeny.*

What can be learned from an analysis of the two axes of the brim during ontogeny up to the age of 14 years?

During the last 6 months of foetal life both conjugate and transverse diameters quadruple themselves, the conjugate on the average being a little less than the transverse. The average brim index happens to be mesatipellic.

From birth to 2 to 3 years of age, both diameters increase by 1½ times their length, and thereafter by progressively smaller

TABLE I. PELVIC GIRDLE.

A Measure of the Relative Increase of Bone Volume and Length During the Periods Under Review.

Ontogenetic phase	Volumetric Vol. increase ÷ Vol. × time increase	Linear Perimeter	Sacral breadth	Conjugate diameter
Second foetal trimester	40.0			
Second and third trimesters	13.8	5.88	4.2	6.2
Infancy until 2 or 3 years	1.06	0.21	0.13	0.17
Infancy until 2 years (Kappers' figures, 1938)	1.27			
Childhood: 2 to 8 years	0.32	0.1	0.06	0.1
Childhood: 8 to 14 years	0.18	0.05	0.04	0.05
Puberty to end of ontogeny Female	0.03	0.02	0.03	0.01
Male	0.004	0.01	0.02	0.002

factors. But after infancy the axes no longer increase pari passu. Thus during infancy the conjugate grows 17 mm. and the transverse 20 mm. In the next 6 years the conjugate grows 29 mm. (or possibly even more) and the transverse 23 mm. From years 8 to 14 the conjugate grows 23 mm. and the transverse 20 mm.

Thus from birth to 14 years the gain in conjugate length is 69 mm. and in transverse length 63 mm., the former outstripping the latter most effectively during the 2 to 8 year age period. After puberty, however, the transverse diameter takes over the ascendancy, as the following figures show. The difference between pubertal and adult values is shown.

Male: conjugate 1.3 mm., transverse 12.6 mm.
Female: ,, 5.6 ,, ,, 19.6 ,,
Average: ,, 3.5 ,, ,, 16.1 ,,

Sacral breadth increases are shown in Fig. 2.

From the above data, then, it is seen that in the postnatal individual there is a very active growth period from birth to the age of nearly 3 years. Secondly, relative activity at the acetabular epiphyses varies during ontogeny in such a manner as to produce at its beginning and at its end (i.e. from the time of adolescence) brims of a low mesatipellic order; but during childhood there is increased growth at these epiphyses which makes the conjugate axis predominate sufficiently to give, on the average, a dolichopellic brim. It is after puberty that the female transverse diameter outgrows the male, even when sacral width is subtracted, and thus causes the iliac bulge which has been ascribed to rickets.

3. *Rickets.*

Concerning rickets it may be supposed, in the present absence of further evidence, that the disturbance it causes in bone growth must be restricted to an influence on endochondral ossification, and this mainly at the acetabulum; and that it is probable that the Y-shaped epiphysis suffers over a period which exceeds the duration of florid rickets, when the latter is judged by general clinical manifestations. At the symphysis pubis anteriorly and the sacrum posteriorly, there are too many muscular and weight-bearing forces respectively to allow their related epiphyses to become unduly involved in the rachitic pathology of even the seriously immobilized child.

It is submitted that it is a mistake to think

that the rachitic effect on the girdle is associated with an actual bending of bone. Such bending occurs only very rarely at the diaphysis of long bones where distortions are due rather to irregular endochondral ossification. The exaggerated rachitic curvature of the lower half of the sacrum is not comparable to what is being considered here; and it must be emphasized that the evidence available is in conflict with the hypothesis in respect of which there is visualized an osseous softening of the girdle accompanied by some degree of antero-posterior collapse. A study of outstanding value by Dunham and Thoms (1945) throws some light on the ultimate fate of the pelvis of the child suffering severe rickets. Ten individuals who had had "the most severe and prolonged type of rickets occurring in early childhood" were re-examined in adolescence. Of the 10 adolescents Thoms considered that only 5 had rachitic pelves, though it must be denied that any unequivocal stigma of the disease is present in the only inlet roentgenogram he shows of the latter group. It is to be noted, however, that florid rickets may leave no recognizable trace in the adolescent pelvis. Is it justifiable, in the light of this and other evidence here produced, to speak as freely as is the custom of the effects of malnutrition on pelvic development? It is unusually difficult minutely to study rachitic processes as they affect the young pelvis.

IB. *Individual variables and their relation to the brim index.*

Having outlined the morphological effects on the brim of growth at the various epiphyses, it is now necessary to examine individual variables and their relationship to the brim index. For this purpose pelves will be divided into two great groups —those with index under 90 and those with index 90 and over. The objective is to discover whether the former, unfavourable group exhibits dimensions which are also unfavourable in the functional sense; and secondly to ascertain which irregularities of growth cause the low brim index.

1. *Brim index.*

(*a*) *Transverse diameter of pelves with brim index under* 90 *and* 90 *and over.*

In both sexes the under 90 group has a greater diameter.

In 100 males the mean difference = 2.53 ± 1.52 mm. = $1.66 \times$ standard error.

In 66 females the mean difference = 6.075 ± 1.86 mm. = $3.28 \times$ standard error.

Only the female difference is significant.

(*b*) *Conjugate diameter of pelves with brim index under* 90 *and* 90 *and over.*

In both sexes the under 90 group has a smaller diameter.

In 100 males the mean difference = 13.49 ± 1.69 mm. = $7.89 \times$ standard error.

In 66 females the mean difference = 10.57 ± 1.76 mm. = $6.0 \times$ standard error.

In both sexes the difference is highly significant.

It is seen, therefore, that the brim index appears to be a function rather of the conjugate than of the transverse diameter. In the male there is only a small difference between the transverse diameters of the two major groups, but a considerable difference in the two conjugate diameters. In the female, however, the under 90 index group is characterized by a significant difference in both diameters, though the conjugate shows a stronger influence in determining the shape of the brim.

A measure of the growth that occurs in the individual groups can be better determined on the basis of the area of the brim. Brim area will indicate to what extent malnutrition has impaired growth, if malnutrition is associated with low indices.

(c) *Planimeter areas of brim in pelves with index under 90 and 90 and over.*

In both sexes the mean area for the under 90 group is smaller.

In 151 pelves of both sexes the mean difference = $=3.89\pm2.43$ sq. cm. $=$ 1.6 × standard error.
In 100 males the mean difference = $=6.1\pm2.64$ sq. cm. $=$ 2.3 × standard error.
In 51 females the mean difference = $=2.9\pm2.87$ sq. cm. $=$ standard error.

The indices were higher than platypellic in 43 per cent of the male and in 49 per cent of the female series. In none of the groups shown for area is there a significant difference. Thus a low brim index pelvis may have a large area, and the evidence is not strongly in favour of increased capacity being dependent on higher brim indices. Further information on this point was given earlier. Thus the correlation coefficient for brim area and index gave the following values:

In 100 males $r = +0.256\pm0.1004$
$=2.56 \times$ standard error.
In 51 females $r = +0.0798\pm0.141$
$=0.566 \times$ standard error.

The association between these two variables is weak, that in the male being possibly significant. A reason for this higher male correlation may be the fact that the lateral boundaries of the brim plane in the male are more streamlined than in the female.

2. *Brim area.*

The contention that the brim index is merely a function of the conjugate diameter, and the possible inference that the greater the conjugate the greater the brim area, may be met by testing the association between the anterior straight breadth of the sacrum and the brim area. A graph plotted with these variables shows a very close relationship between them, a feature which is more pronounced in the male than the female. There are a few exceptions, and in one direction (narrow sacrum with great area) they tend to be of the anthropoid type pelvis, and in the opposite direction the android type. This explanation, however, did not fit the male exceptions adequately, and a better hypothesis was found—one which accounted for all the exceptions. When the difference between brim transverse diameter and sacral width exceeded the average, the probability that a narrow sacrum would occur with an excessive brim area increased, and vice versa. Hence it follows that the size of the brim plane is determined in a large proportion of cases by the breadth of the sacrum, but even more directly by the brim transverse diameter in which the iliac bulge is, of course, included. Scatter diagrams of the distribution of 101 pelves of which the planimeter area of the brim is known show that area is related most intimately to the transverse diameter, in less degree to sacral width, and least of the three to conjugate diameter.

The sacrum of the giant anthropoids is very much narrower than that of man. Man is the only primate with sacral index above 100, and has developed a sacrum which is wider absolutely and relatively. This comparison with man is striking when taken against the chimpanzee, orang, and gorilla which have all got poorly developed sacral alae: the gibbon has a good alar development and a relatively wider sacrum, and this feature is even more pronounced in certain specimens of Pithecus rhesus. Gorilla has a pelvis with high brim index, great brim area, and narrow sacrum: the area of the brim plane is due to great growth at acetabular and symphyseal epiphyses. The Pecos Indian pelvis shows the reverse features of low brim index, very wide sacrum, and average brim area for small type pelves. The Veddah pelvis lies practically on the regression line of sacral breadth upon brim area.

II. *Development of the sacral alae.*

Pronounced development of the lateral border of the sacral alae has the effect of placing the sacrum relatively further posterior than in the presence of weak development. The result of the former is to increase anterior sacral curvature. Increased curvature would, in a given pelvis, increase antero-posterior brim length. Whether this mechanism actually plays a significant rôle in the brim index variations of a series of pelves may be tested by calculating the correlation coefficients between the curvature index on the one hand and the brim index or the conjugata vera diameter on the other.

r (anterior sacral curvature index and brim index)
$= +0.288 \pm 0.143$ in 50 males
$= 2.014 \times$ standard error.
$= -0.29 \pm 0.125$ in 65 females
$= 1.83 \times$ standard error.

While both values are of a low order, it will be observed that the negative correlation of the female is the expected one: the positive r of the male may have arisen owing to some chance based on brim index factors which have a much greater influence than sacral curvature.

r (curvature index and conjugata vera)
$= -0.09 \pm 0.143$ in 50 males
$= -0.116 \pm 0.124$ in 66 females.

In neither sex is r significant, though here the expected negative value occurs in both.

It is concluded, therefore, that the sacral ala plays a statistically insignificant, and accordingly negligible, part in the adult brim index.

III. *Pathological bending of the girdle due to antero-posterior compression.*

(*a*) It has already been shown that in the female there is a greater bulge at the iliac portion of the illiopectineal line than in the male. This bulging is obviously a sexual character, but has been confused with hypothetical rachitic bending of bone due to antero-posterior compression.

Fig. 1 shows how closely the brim index follows the conjugate-sacral index. The correlation coefficient for these two variables is $+0.804 \pm 0.1$ in 100 males, and $+0.813 \pm 0.109$ in 61 females. Fig. 2 shows that low brim indices are not associated strongly with great differences between brim and sacral widths. Both these characters are held to be present in rachitic pelves; but it is now seen that one may occur without the other in the absence of gross rickets or, what is more important, in the presence of possible sub-clinical rickets. This is confirmed by the finding, shown earlier, that brim indices of pelves with a marked transverse or iliac bulge are lower, but not significantly lower, than those with a slight bulge.

How do the factors causing this iliac bulge affect true conjugate length and the planimeter area of the brim? The evidence adduced is unexpected, and shows that both the linear and two dimensional values are increased by its development. This suggests that the iliac bulge is dependent on a growth increase which is accompanied by parallel activity in the remaining epiphysial cartilages. On the average, therefore, we are not witnessing mechanical compression followed by pathological warping, but vital morphological variations based on active bone growth. The evidence referred to is as follows.

The pelves were divided into two groups, according to whether the iliac bulge was above the mean or not in the case of the conjugata vera, and below 10 mm. or not for the area. The mean iliac bulge (transverse diameter of brim minus sacral breadth) was 13 mm. in the female and 8 mm. in the male. Conjugate and brim area values were analysed for their respective groups and compared, and it was found

that in all cases the mean values were higher in the groups with greater iliac bulge.

Conjugate vera.

Male mean difference = 0.79±2.16 mm.
= 0.37 × standard error.
Female mean difference = 4.96±2.16 mm.
= 2.3 × standard error.

Planimeter area of brim

Male mean difference = 7.75±2.56 sq. cm.
= 3.03 × standard error.
Female mean difference = 4.79±2.72 sq. cm.
= 1.76 × standard error.

Statistical significance is claimed for the conjugate difference in the female, and the area difference in the male.

It is seen, therefore, that a pronounced iliac bulge occurs in the better developed, and accordingly more robust, pelves. Pathological softening of bone with warping need thus not be postulated to explain an iliac bulge which is above average in 42 per cent of both sexes in the Bantu. Examination of frankly rachitic material will show the degree of bulging that occurs in rickets.

(*b*) Warping of the brim which is pathological has not been proved to affect the transverse diameter but, if it does occur, it must affect the length of the antero-posterior diameter. The latter diameter will be diminished wherever the bending due to an antero-posterior force is situated. The only possibility that remains, having regard to the argument advanced under III(*a*), is rachitic bending of the superior rami of the ossa pubis.

The stresses affecting the pubis are not so great as those borne by the body of the ilium, for the pubis is merely a continuation of the lever beyond the femoral fulcrum to give origin to the anterior abdominal wall muscles and some of the adductors of the thigh. Whereas these muscles play some part in the maintenance of the erect posture, the body and adjacent portion of the ala of the ilium form a segment of the pillar that bears the weight of the trunk. The complete collapse of the anterior half of the inlet seen in osteomalacia is a different problem, and may be due to muscular action rather than to mere pressure of the femoral heads on the acetabula: in the erect posture, at least, the lines of force at the acetabula have only a very slight medial tendency.

Because rachitic dry pelves are not available for this investigation, a pronouncement on the pubic response to rickets must be postponed meanwhile. The opinion may be expressed that even in the face of florid rickets, muscular pull based on the functions of the abdominal musculature will be continually exercised even in an incapacitated child; but that in the patient under discussion stimulation of the acetabular epiphyses by the femoral head will be reduced to a minimum. If this suggestion has any basis of fact, it would follow that the Y-shaped epiphysis would be disturbed more than the symphyseal cartilages, with resultant loss of growth in antero-posterior length.

IV. *Anterior projection of the sacral promontory.*

The female pelvis was examined in conjunction with a series of male pelves with a view to assessing the influence of the forward promontory on the brim index. The apparent anterior projection of the sacrum is based on its proximity to the greatest transverse diameter of the brim: pelves thus characterized may be described as having a short posterior segment of the inlet. These pelves may have both a high index and a great area of the brim; and it does not appear that anterior projection of the promontory is an important factor in producing a low brim index.

What is the cause of the promontory

being situated so close to the greatest brim transverse diameter? In the male it is a characteristic that the posterior extremity of the ilium is rotated downwards so as to cause a narrowing of the greater sciatic notch. While the main effect of this is to carry the lower part of the sacrum forward, the promontory itself is caused to lie relatively further forward than it does in a typically female pelvis. But a more important point seems to be the probability that the position of the transverse diameter has been moved closer to the promontory than the reverse case considered above. This is due to poor development of the iliac bulge mentioned previously. Inspection of a male pelvis will demonstrate a flattened iliopectineal line running from the sacro-iliac joint; this part of the brim may be so slightly curved that measurement shows its widest part to lie at, or close to, the sacro-iliac joint. The typically female pelvis, on the other hand, has a full curve of the ilium tending outwards from the sacro-iliac joint and coming in again on the acetabulum. The greatest transverse diameter in the latter case is accordingly measured near to the centre of the iliac portion of the brim, and thus well anterior to the sacro-iliac joint. The longer the body of the ilium, the longer will the posterior segment be.

The Bantu material illustrates the following facts. (1) The android type pelvis in the female has a comparatively wide sacrum. It may be presumed that considerably increased growth at the symphysis pubis would be required to provide sufficient bone for a good bulge in the iliac region. (2) The anthropoid type pelvis has the narrowest sacrum, with the gynecoid type intermediate between android and anthropoid in this respect. (3) The ratio of the lengths contributed by pubis and ilium to the formation of the brim are not different in high and low index brims.

The general conclusion follows that loss in the antero-posterior length of pelves which appear to have an anterior projection of the sacral promontory is compensated by narrowness of the brim. The tendency for such pelves is to preserve a brim index comparable in value with the mean. Low values are likely to occur when sacral breadth is pronounced, a possibility illustrated well by the Pecos material.

Discussion.

I. *Radiology and the position in general.*

No student of pelvic morphology can fail to be impressed by the implications of the pelvic brim index. In the study of the Bantu pelvis, and more particularly of its ontogenetic development, the index has played a prominent rôle; and for more than a year one's chief considerations have been guided by the belief that the dolichopellic pelvis occurs more frequently in privileged communities than in those stricken with malnutrition and morbidity. The view is widely held that in certain races the dolichopellic pelvis predominates. This type of pelvis is the most efficient in parturition and is comparatively rarely associated with dystocia. Quite unprecedented momentum was given to the nutritional aspect of pelvic form when Greulich and Thoms (1939) reported that in a series of 104 nulliparous nurses of superior economic and physical status the brim index was considerably higher than in large series of Thoms' free hospital patients. Not only was the index higher in the nurses but, what is more significant, these young American women gave an average value of nearly 100. No discovery in the field of pelvic development and anatomy was more important than this finding which has been commented upon by others, e.g. Ince and Young (1940) and Nicholson (1945).

The Bantu studies have led to a pronouncement concerning the evolution of the

pelvis (Heyns, 1946). This and other considerations have consistently proved to be irreconcilable with the view that highly favourable living conditions have a pronounced influence on the development of the capacious, ultra-dolichopellic pelvis. In revising this view the surprising fact emerged that the only authentic evidence in its favour was that produced by Thoms; and it appeared probable that this evidence had been more impressive because of its advent at a time when much thought was being given to nutritional problems. It is curious that Thoms did not make greater endeavour to emphasize his discovery. However, his results were questioned in spite of the belief that human physical development in the United States has far outpaced that in other contemporary countries, and that a comparable peak of growth has probably been reached by none save the ancient Egyptians and Greeks (Hrdlicka: Mills, 1937).

It has been questioned (Heyns, 1944) whether Thoms' radiographic method of pelvimetry was above criticism, but our familiarity with the possibilities of his technique reassured us; and there remained the almost unassailable point that an error present for one series would apply correspondingly to another. Furthermore, as the hospital patient series provided a mean index similar to that of English women and the Bantu, it appeared that Thoms' nurses must in fact predominantly possess such pelves as occur in not more than 20 per cent of other known groups. An investigation into the matter has provided evidence which shows that Thoms' clinic women probably have a mean brim index well below 90, and that his nurses have indices not at all different from those of English or Bantu women. The proof of this assertion has been published elsewhere in order to abbreviate the argument of the present report (Heyns).

II. *Outline of the effects of epiphysial growth.*

A glance at Table I will show that growth activity diminishes steadily with the advance of ontogenetic age. This is true for all the calculations shown, without exception, and these include increase in volume and in length of the bone of the girdle proper. While it is true that the first three years of life represent a very active growth period, the foetal period exhibits greater activity which can be shown to decline appreciably during each trimester. It is, therefore, more precise to visualize the increase of bone as becoming slower and slower; and to seek linear increase over arbitrary periods only in an attempt to study the relative activity of different epiphyses during those periods. It will be realized that conclusions drawn from growth data are restricted by the fact that all the cells present at a given time are not proliferating: growth in length (not girth) occurs only at epiphysial ends of the existing length of bone, and the rest of the bone may for our particular purpose be considered as passive and stationary. The calculations in Table I are based on the proportion of increase to previous value, and carry the presumption that the greater the segment of bone the greater are its advantages for growth. The surface of an epiphysis is no doubt greater at 8 years than at 2 years of age, but it is obvious that epiphysial growth cannot be expected to be proportional to diaphyseal length.

Should linear variables in the brim plane be considered, it will be found that anterior sacral breadth and the brim transverse diameter increase relatively by about the same length during the three postnatal periods of birth up to 2 to 3 years, 2 to 8 years, and 8 to 14 years. The conjugata vera, on the other hand, grows during these phases respectively 17 mm., 29 mm. (or possibly more), and 23 mm. From puberty

to the adult state the conjugate increase is 5.6 mm. in the female (male 1.3 mm.), brim transverse increase 19.6 mm. in the female (male 12.6 mm.), and sacral breadth increase 14 mm. in the female (male 11 mm.).

Table II is an attempt to estimate the exact amount of linear growth at the three sets of epiphyses that enter into the present problem. The assumptions involved here are that increase in antero-posterior length can only occur at the acetabular epiphyses, and increase in lateral or transverse length at both sacral and symphyseal epiphyses. The possibility that muscular traction at the symphysis pubis in a posterior direction may cause physiological bending with decreased curvature or flattening of the brim has for the present been disregarded. In Table II the figures in the column headed "Acetabulum" are based directly on increase in conjugata vera length, those under "Sacrum" being similarly derived from the breadth of the sacrum where it is in relation to the iliopectineal line. Symphyseal growth has been based on the difference between the transverse diameter of the brim and the breadth of the sacrum, for it follows from the premise stated that the iliac bulge can occur only as the result of growth at the symphyseal epiphyses.

If the above argument is accepted, Table II shows that growth at the symphysis is comparatively slight, and that this growth is at its lowest level from about 8 years to puberty. During this phase the acetabular epiphyses are making a considerable contribution to conjugate length, an activity which is most pronounced between 2 and 8 years. This would explain the preponderance of conjugate over transverse diameter which has been observed by other investigators, and is the reason for the prevalence of dolichopellic pelves at this time. From puberty to the end of ontogeny epiphysial growth at the symphysis reaches such a high level that it progresses pari passu with acetabular increase in length. A new feature manifests itself at this time, for the sex factor has emerged and is

TABLE II PELVIC GIRDLE

Growth During Ontogeny at the Three Double Sets of Epiphyses.

The figures indicate the growth in mm. that has taken place between two consecutive periods.

Period		Site of Epiphysis		
		Symphysis	Sacrum	Acetabulum
I(*a*)	The last prenatal 6 months	2.25	25.1	25.25
I(*b*)	The entire prenatal period	?	37.0	33.0
II	Infancy (2 to 3 years)	6.0	14.0	17.0
III	At 8 years	6.0	17.0	29.0
IV	At 14 years (early puberty)	3.0	17.0	23.0
V	After puberty Female	5.6	14.0	5.6
	Male	1.6	11.0	1.3
		T.B.—sacral width	Sacral width	Conjugate vera
Adult means	Male	20.6	98.8	107.6
	Female	16.8	95.0	103.3

associated with much diminished, though equal, growth at these epiphyses in the male. The fact that the adult male pelvic brim exhibits a very poor iliac bulge strongly supports the view that this difference between brim and sacral widths is due to bone growth at the symphysis rather than to bending of the bone by antero-posterior muscular force. By the same token, it is improbable that the iliac bulge is produced by the counteraction of a bending moment due to augmented osseous proliferation on the outer aspect of the body of the ilium.

It cannot be denied that during the cartilaginous prenatal stages bending of the pubes may require to be postulated in order to account for the rounded contour of the forepelvis, for it has not been proved that symphyseal growth occurs in the first trimester. About the fourth intra-uterine month sacral breadth is 2.25 mm. greater than the greatest brim transverse diameter. This may mean that sacral growth has been much more rapid than pubic growth at the symphysis, or alternatively that pubic growth has been negligible and the rounded shape of the forepelvis is due to mechanical curvature based on muscular forces. At the end of foetal life, however, the brim transverse is only 0.1 mm. less than sacral breadth, which suggests that in later foetal life symphyseal growth has taken place. The first few years of postnatal life are characterized by pronounced growth at the symphysis (Table II). It must be recognized that the bending of bone referred to would take effect in the pubic region, and that this hypothesis is not called for except to explain the form of the forepelvis in the possible absence of symphyseal bone growth in early foetal life. All the available evidence points to symphyseal growth as the basis of the iliac bulge.

Sacral growth during ontogeny is reflected in Table II, and it is seen that adolescent growth is similar in the two sexes. During adolescence the lateral and anterior epiphyses grow at an equal rate in either sex. Two female features are (*a*) that growth exceeds that of the male, and (*b*) that the symphyseal epiphysis exhibits pronounced rejuvenation. The factors responsible may be hereditary or sexual, or both. If sexual, increased vascularity and hormones are possible causes. It is improbable that during puberty vascularity is different in the sexes, but it is possible that the genitalia afford an increased circulation to the anterior pubic region rather than to the lateral and posterior parts. With reference to endocrine influences, the evidence is conflicting. On the one hand hypo-ovarianism is associated with late union of epiphyses and excessive growth in stature; on the other, it is known that callus formation (Hills and Weinberg, 1941) and ossification (Pfeiffer and Gardner, 1938) are stimulated in the presence of oestrogens. The latter processes are not directly related to epiphysial growth; and it is well known that thyroid, parathyroid, and hypophyseal secretions are all intimately concerned with growth in general. The problem of pubertal bone growth is, therefore, a complex one.

What is known from observation, however, is that the limb of the Y-shaped epiphysis between pubis and ilium is the first acetabular unit to unite by osseous fusion, an event occurring in late puberty; but that the symphyseal epiphysis becomes obliterated towards the end of ontogeny. Throughout ontogenetic development the evolution of the erect posture is associated with increased muscular strain at the symphysis pubis, and it is possible that these strains result in stimulation of growth at the symphysis. As the mammalian scale is ascended, the pelvic brim develops from a triangular-shaped girdle to one with an ovoid and

finally a rounded contour. It was submitted elsewhere (Heyns, 1946) that the purpose of evolution is to produce in man the ultra-dolichopellic pelvis. This hypothesis was discussed as being compatible with Bolk's retardation and foetalization concept (1925–26) which suggests that morphologically the apes have advanced much further than man along the road of evolution. These views are merely hypothetical, and the present report explains the mechanism by which the end-result is obtained, and how the dolichopellic pelvis of childhood becomes the platypellic pelvis of the adolescent and adult. The present report is stated to be preliminary for two reasons: (1) While general observation suggests that the greatest proliferation and accumulation of bone on the outer aspect of the body of the ilium is not associated with conspicuous iliac bulge, this correlation has not been studied exhaustively. (2) Cartilaginous activity at the symphyseal epiphyses is being studied histologically both in the foetus and in the child, and collection of the post-natal material is slow.

III. *Physiological bending of the pelvic girdle.*

It has been argued that rickets in mild form cannot on the evidence available be convicted of flattening the pelvic girdle. There can be little doubt, however, that physiological bending of the bone must occur during ontogenetic development. The only reasonable explanation, for example, that accounts for the phenomenon of the iliac bulge is that symphyseal epiphyses contribute to the perimeter of the girdle to the accompaniment of bending. This bending will occur in front most directly, and produce a rounded contour of the forepelvis; but bending forces can also be transmitted to the ilium further back. It is certain that increase in sacral breadth cannot contribute to the iliac bulge. Thus it is necessary to formulate a working hypothesis which will explain physiological bending. The adoption of the erect posture is responsible for the play of many forces in the region of the body of the pubis, for the anterior abdominal muscles and the adductors of the thigh gain origin here, and the psoas muscles make pressure on the superior pubic ramus. These forces probably pull the symphysis backwards and contribute to the rounded contour of the forepelvis (compare other primates and lower mammals). The conjugate shortening that follows is restored by growth at the acetabular epiphyses. Epiphyseal growth at the symphysis may, therefore, be devoted largely to widening of the brim in the region of the ilium, such bending as occurs at the pubes having been produced mainly by muscular forces. It is true that more symphyseal growth may occur than is shown merely by increase in the iliac bulge, but it is possible that the latter may represent a great preponderance of the growth.

The bending moments set up at the iliac bulge by increase in sacral breadth may be counteracted by periosteal growth which is greater on the outer than on the inner aspect. This will have the effect of increasing the bulge. Examination of pelves, best exemplified by the male, shows that the thickest bone growth in this region usually corresponds to the smallest bulges. To enter further into this problem of bending of the girdle would lead to pure conjecture and an attempt to explain such hitherto unsolved mechanical aspects of bone growth as remodelling.

A few applications of the above hypothesis may now be considered. The iliac bulge increases with time up to adolescence and, therefore, as the bone becomes more rigid. It appears unlikely that bending due simply to bone softening would behave in this chronological manner. It seems as if

perfectly balanced growth in the human pelvis is characterized by active growth in sacral width, and an unexpected increase at the pubic symphysis—both factors tending towards great width of the brim. And this tendency is essentially a human feature, only poorly exhibited by the other primates, but most conspicuous in the human female. Activity at the Y-shaped epiphysis in this nicely balanced pelvis is, however, so pronounced that a mesatipellic instead of a low platypellic brim index is produced at the end of ontogeny. It is obvious that sometimes the symphyseal epiphysis will outgrow the acetabular and produce platypelly, and sometimes the reverse process will lead to dolichopelly. In the background of all this activity there hovers the sacrum: it has a profound effect on the ultimate index of the brim. There is no evidence at present to support the view that superb nutrition will permit of less bending and result in a higher incidence of ultra-dolichopellic (anthropoid) pelves. In truth, the facts are opposed to such a possibility. Inspection of round and even low index pelves gives the impression of unrestricted growth: they are usually capacious and have a marked iliac bulge which suggests active increase of osseous tissue.

Practically all pelves with brim index below 80 have either unusual relative sacral breadth or a marked iliac bulge, or both. Where indices of 100 or over occur, the reverse is the rule, viz., relatively narrow sacrum with slight iliac bulge, or both. The factor on which the "relative" size of the pelvis may be usefully based in this connexion is the conjugata vera length. Thus pelvis A730, 721 with conjugate 99 mm. might be expected to have dimensions below the average: its sacral breadth of 105 mm. is near the average but broad for such a small pelvis; the iliac bulge contributing 30 mm. is conspicuous—and the brim index finally shows the low figure of 73.33. This pelvis has a brim area above the average, and it is submitted that inlet size was increased by relatively great growth at the sacral and symphyseal epiphyses. It is obviously possible that retardation of acetabular growth was the primary feature in the development of this pelvis, and that in fact the inlet should have grown excessively. The contention is, however, that robust growth at the anterior and posterior epiphyses gave the pelvis adequate capacity, and that it was not primarily warping that reduced conjugate axis and index and thus diminished the inlet area.

A682,683 had a brim index of 69.63 with conjugate diameter only 94 mm., sacral breadth 114 mm., and iliac bulge 21 mm. The brim area was just less than the average. A831,844, an ultradolichopellic pelvis, had a brim index of 103.65. The conjugate diameter was above average at 115 mm., but sacral breadth below average at 101 mm. As the iliac bulge contributed only 10 mm., the greatest transverse diameter was 8.5 mm. below average and the brim index rose to over 100. A831 with index 103.65 and A682 with index 69.53 have equal brim areas. The three specimens referred to are female.

Increase in sacral breadth alone augments the transverse axis of the brim by a proportional factor and the conjugate axis by about half this factor. This may be shown experimentally by expansion in metal rings made to represent the girdle. The iliac bulge is not affected.

Summary.

Part I. General.

A. The significance of the pelvic brim index is stated, and reference made to the belief that under favourable, healthy living conditions the index appears to be higher than in circumstances of poverty.

B. The brim index in different races is surveyed, and Bantu figures are included.

C. Ontogeny and phylogeny are considered under two heads: (*a*) General, and (*b*) Bantu data.

Part II.

Analysis of Anatomical Observations.

A. The validity of certain current hypotheses is tested: correlation coefficients for brim index and brim area, and for brim index of conjugata vera over sacral breadth; the basis of antero-posterior flattening in rickets; the relation of bulging at the iliac portion of the illiopectineal line to rickets.

B. The factors influencing the brim index are considered under four heads.

1(*a*) Epiphyseal bone growth.

The mechanism of increase in size of the pelvic girdle is considered; and the increase during ontogeny of the brim axes and sacral breadth is analysed. The effect of rickets on growth processes is discussed.

1(*b*) A statistical analysis of individual variables and their relation to the brim index is presented.

2. The effect of good development of the sacral alae. This was found statistically to be negligible.

3. Pathological bending of the girdle due to antero-posterior compression is considered, but there appears to be no evidence in favour of this possibility in cases of mild rickets.

4. The effect on the index of anterior projection of the sacral promontory is analysed anatomically, and an explanation offered of its lack of significance relative to index variations.

Discussion.

1. Radiological implications and the position in general. There is no evidence that malnutrition of moderate degree influences the brim index.

2. An outline of the effects of epiphysial growth is given. Emphasis is laid on bone growth at the symphyseal epiphysial cartilages which are an important factor in increasing the transverse axis of the brim. It is submitted that it is to activity in this region that the human girdle owes its morphology.

3. Physiological, as opposed to pathological, bending of the pelvic girdle is considered to be present. The mechanics of this factor is complicated, and is not susceptible of simple experimental proof.

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The Technique of the Lower Segment Caesarean Section

BY

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ALTHOUGH the advantages of the lower uterine segment operation have long been recognized, many obstetricians, even nowadays, prefer the classical Caesarean section, due probably to the difficulty of access to the lower uterine segment region.

When, however, the technique of this excellent operation has been more fully developed, the difficulties in performing it will be overcome and this will lead to even better results than are now obtained.

In view of this there is a great need for exchange of ideas among obstetricians about the technique used by them in performing the lower segment operation. The fact that modern obstetrics permits a great number of relative indications for Caesarean section makes the matter still more important.

The technique of Caesarean section used in the Paderewski Hospital allows us, in our opinion, to overcome many difficulties caused by insufficient access to the operation field. At the same time some factors can be avoided, which, apart from making the operation more difficult, may prevent a quick convalescence and the attainment of the best anatomical and functional results.

It has long been our custom to perform the operation in the middle of the first stage of labour if conditions permit. As labour becomes more advanced a still lower part of the uterine segment can be chosen for transverse incision. When the cervix admits the insertion of 4 fingers, the incision can be made in the supravaginal part of the cervix, just above the attachment to the vaginal wall. The passive uterine segment is greatly expanded at this time and the scar after complete involution of the uterus is very small for this reason. The risk of rupture of the scar is thus considerably diminished in the event of a subsequent labour. However, there is no objection to performing the lower segment operation even before the onset of labour, because, as we know, the lower uterine segment becomes sufficiently thinned during the last weeks of pregnancy. In cases, however, where the lower uterine segment is not sufficiently expanded, it may be advisable to make a longitudinal incision in the uterine wall instead of the transverse one, the technique of which is here described.

The patient is placed in the usual position for any gynaecological abdominal operation. Trough-shaped knee supports are used in place of the lower leaf of the operating table, and the legs are drawn apart as the patient lies on it. This leaves sufficient space to enable a second assistant to stand between the legs during the operation, giving him good access without interfering with either the surgeon or the first assistant. The thighs are slightly raised above the level of the trunk. The operation is performed in the Trendelenburg position, the degree of inclination depends upon the state of the patient and is such as just to make the lower abdominal wall horizontal.

Pfannenstiel's transverse abdominal in-

cision is generally used in our hospital. Besides giving good cosmetic results, it probably diminishes the symptoms of peritoneal reaction after the operation. Although this opening is usually sufficient for the lower segment operation, it takes longer to make, and the access to the operating field is less than with the longitudinal incision. For these reasons it is best to employ the usual longitudinal opening of the abdomen in urgent cases and for obese patients.

If the abdominal incision in the middle line is used it is of great importance to incise the abdominal fascia and the tendons between the pyramidal muscles as far as the symphysis pubis. This facilitates access to the lower uterine segment. The bladder runs little danger of being cut by this incision. The danger of injury to the bladder must be taken into account only when incision of the peritoneum and its preperitoneal fat is made. For this reason the first incision of the peritoneum should be made high, and afterwards extended downwards with care.

After the opening of the abdominal cavity two abdominal retractors may be introduced which are directed downwards and laterally. This gives better access to the lower uterine segment than the use of only one broad retractor. In order to prevent the liquor amnii getting into the peritoneal cavity two large swabs wrung out in physiological saline are put between the abdominal wall and the uterus. The swabs converge behind the upper part of the abdominal opening and their lower ends lie in both the lateral parts of the uterovesical fold of the peritoneum. This isolates the peritoneal cavity sufficiently from the immediate operation region.

From this point the operation can be divided into the following stages:

(1) *Detachment of the bladder.* The uterovesical fold of the peritoneum is incised transversely from one round ligament to the other. The loose connective tissue under the peritoneum which surrounds the bladder is dissected up to the uterine wall and later the bladder is detached by blunt dissection to the region of the vagina.

Details. The peritoneum covering the bladder is held in the centre by surgical tissue forceps about an inch below the place where it is attached to the uterine wall. The incision into the stretched peritoneum is made by blunt-pointed scissors half an inch below the tissue forceps and it is extended horizontally on both sides as far as the round ligaments. If the peritoneum is folded, the cutting can be made easier by the assistants raising and holding the round ligaments in position to stretch the peritoneum.

Holding up the peritoneum of the bladder in the centre with the dissecting forceps, the loose connective tissue under it and around the bladder is stretched and clearly visible. By cutting this tissue with scissors, held concave side to the uterus, the right layer between the uterus and the bladder is reached. Later by blunt dissection with closed scissors, still held in the same way, the bladder is detached from the uterine segment, first in the middle line, then laterally. Great care must be taken not to go beyond the uterus towards the sides in order not to injure the blood vessels in the parametrium, and not to enlarge the wound space unduly. If the correct layer of dissection has been chosen there should be no bleeding during the exposure of the lower segment. This blunt dissection can also be performed with a straight retractor* instead of scissors, because the connective tissue is usually sufficiently loose. A thin layer of connective tissue is left on the surface of the lower segment.

On very rare occasions the exposure of the lower uterine segment must be made by cutting with scissors between the walls of the bladder and the the uterus when post-operative or post-inflammatory induration of the connective tissue exists. For this purpose the bladder wall is held up by the tissue forceps directly above the place of dissec-

*A narrow, oblong, slightly hollow blade with a bayonet-shaped link between blade and handle.

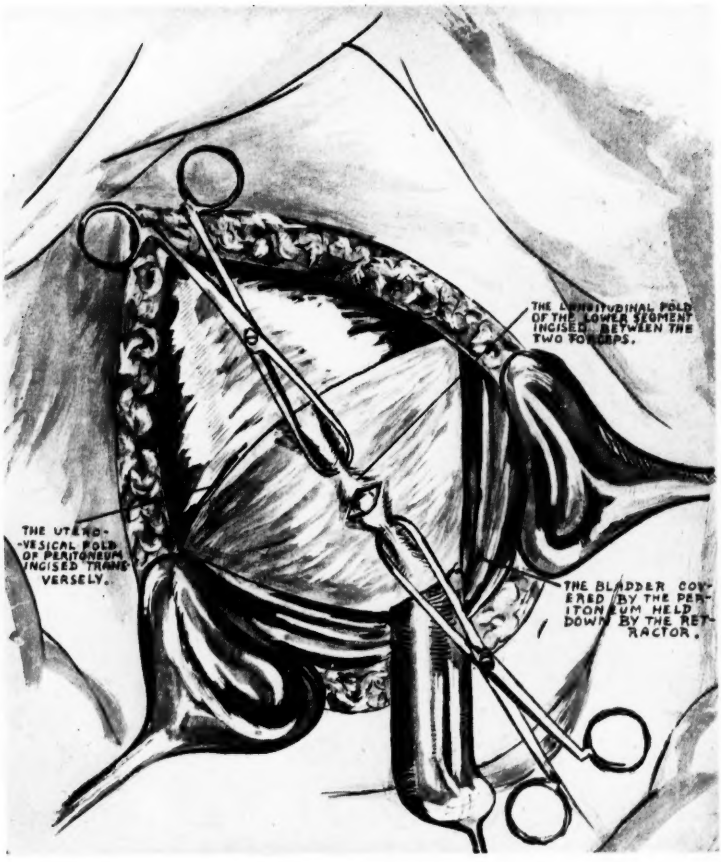
THE LONGITUDINAL FOLD OF THE LOWER SEGMENT INCISED BETWEEN THE TWO FORCEPS.
THE UTERO-VESICAL FOLD OF PERITONEUM INCISED TRANSVERSELY.
THE BLADDER COVERED BY THE PERITONEUM HELD DOWN BY THE RETRACTOR.

FIG. 1.

The abdominal cavity is opened along the middle line. The detached bladder is held down by a retractor. The exposed lower uterine segment is folded by two forceps and a small incision is made between them.

[Drawn by Z. Szulec, Polish School of Medicine, Edinburgh.]

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tion. Such cases are very rare and, if met with, the area involved is small.

(2) *Transverse incision of the lower uterine segment.* A longitudinal fold of the wall of the lower segment is made by clamping it with two Allis's forceps one above the other. This fold between the two forceps is cut through to a sufficient width to permit the tube of the aspirator* passing through it in order to drain off the liquor amnii (Fig. 1). After this liquid is withdrawn the incision is enlarged transversely right and left about 2½ inches on each side.

Details. By clamping the exposed uterine wall with two Allis's forceps one above the other we form a longitudinal fold. Holding the forceps vertically (the surgeon the lower one, the assistant the higher one) the surgeon makes a transverse incision half an inch long with a knife between the forceps. The raising of the fold of the uterine wall prevents all danger to the child. In any case in which the lower uterine segment is not thin enough to permit the clamping of Allis's forceps through its whole thickness, the forceps must be transferred—perhaps more than once—from the more superficial to the deeper layers.

The edges of the uterine segment do not bleed because of the compression made by the above-mentioned forceps. The cannula of the aspirator is inserted in the opening and pushed gently upwards between the presenting part of the child and the uterine wall into the amniotic cavity and the liquid is almost entirely drawn off. The incision is enlarged by cutting with straight scissors to the right and to the left, slightly curving upwards if the previous incision has been placed very low. During this enlargement the uterine wall is pulled up to avoid injury to the child. An incision about 5 inches long is sufficient for the extraction of the foetus. The edges of the uterine incision bleed very little, if the lower uterine segment is well stretched and expanded as a result of labour. Otherwise, there may be free bleeding usually near both angles of the wound but it is easily checked by clamping the edges with Allis's forceps while cutting. The incision is placed ¼ inch below the upper edge of the peritoneum, leaving sufficient room for sutures. If the lower uterine segment is widely expanded the incision can be made even lower, but not too low because of the pubes, and in order not to increase the difficulties of access to the operation field.

(3) *Extracting the child.* In the case of a vertex presentation the obstetric forceps are applied for the extraction of the head. Then the surgeon, pulling with the index finger placed under the axilla, disengages the anterior shoulder and arm and then the other shoulder and arm in the same way.

In the case of a breech presentation the surgeon first seeks and disengages both legs, then the shoulders and arms, and extracts the head by means of a manoeuvre very similar to the Mauriceau-Smellie method.

Details. If the incision in the abdomen is rather small the abdominal retractors are withdrawn in order to have more room for extracting the child. The forceps in the middle of the lower edge of the incision is also removed. The midwifery forceps is applied under the guidance of the hands. If the head is partly or wholly engaged the forceps is applied with the pelvic concavity turned to the pubes. If the head is movable above the brim the pelvic concavity is turned the opposite way. The extraction of the head is completed by directing the traction forwards and upwards, so that the vertex appears in the opening first after which the forehead is gradually eased out behind it. For a high head, one blade of a pair of forceps may be used. It is introduced from the pubes and then passed gently behind the head. The head is drawn out through the opening by raising the blade of the forceps and pushing the head with the other hand in the direction of it. The extraction of the body is completed by pulling with the finger passed under the anterior axilla, so that the shoulder is withdrawn and the arm disengaged, then the other shoulder and arm in the same way. After the child has been separated and handed to the nurse, the abdominal retractors are applied again.

*The cannula of the aspirator should be 10 inches long, curved and provided with several small openings around its end.

4) *Removing the placenta.* An injection of 1 c.cm. of pituitrin is made into the active part of the uterine wall. The placenta is removed by firmly pressing on the uterine fundus and pulling the cord gently, but not before the uterus is very well contracted as a result of the pituitrin injection.

Details. Immediately after the child has been extracted the assistants swab away the rest of the liquor amnii and the blood from the operating field and clamp the bleeding vessels. After the surgeon has handed the child to the nurse he injects into the active part of the uterus 1 c.cm. of pituitrin. In order to do this he exposes the anterior wall of the uterus by pulling down the upper edge of the incision with Allis's forceps. While waiting for the injection to act two Allis's forceps are placed at the right and left angles of the incision. The number of Allis's forceps used depends on whether the wound is bleeding or not. If the wound is not bleeding 4 forceps, at least, are used; one at each end and one each at the upper and lower edges of the incision. This gives the operator better control of the uterine cavity and also helps him later in the insertion of sutures.

When the uterus is well contracted the placenta is separated and removed by pressure on the fundus of the uterus and by gently pulling the cord. The pressure should not be too great, lest the placenta be torn. It is seldom necessary to separate and remove the placenta by hand as the above method is quite sufficient in most cases. When the surgeon is sure that the whole of the placenta and membranes are removed, the cavity of the uterus is packed with a swab. It stimulates the contractions of the uterus and prevents bleeding from the placental site during the first stages of suturing of the uterine incision. The packing is removed when two-thirds of the uterine incision is sutured.

(5) *Suturing the uterine incision.* The opening of the uterus is closed by two tiers of continuous catgut sutures.

Details. A continuous catgut suture is inserted beginning from the angle on the assistant's side. The assistants raise and join the two edges of the incision by holding them together with forceps. The stitches are inserted 3 to 10 mm. from the edge of the wound according to the degree of expansion of the lower uterine segment. If the wall is greatly thinned the distance from the edges must be nearer 10 mm. The sutures should just miss the decidua. Almost every third stitch is looped. The next tier of continuous catgut suture covers the first one and folds the wall of the lower uterine segment. This second suture may also be interrupted. The stitches of this tier must not be too wide nor too deep in order to avoid injuring the blood vessels especially near the two angles of the wound where the risk is greater because of the larger vessels. Last of all the incision in the utero-vesical fold of the peritoneum is closed with a continuous catgut suture.

(6) *Toilet of the peritoneal cavity.* After the swabs are withdrawn the lower part of the peritoneal cavity, especially the pouch of Douglas, should be wiped out with gauze. In cases where infection of any kind is suspected the peritoneum of the vesico-uterine pouch and pouch of Douglas is dusted with sterile sulphanilamide powder, as also the tissue between the layers during the closing of the uterine incision.

Then the abdominal wall is closed in the ordinary way.

Discussion.

In the above description of the technique used some facts of particular importance should be emphasized. They concern first the detachment of the bladder. The incision of the vesico-uterine fold of the peritoneum should not be too close to the peritoneum where is it firmly attached to the uterine wall. This makes it much more difficult to find the right layer between the bladder and uterine wall and often causes the cutting of blood vessels. Later this hinders the operation. If the incision in the peritoneum is performed about $\frac{1}{2}$ to $\frac{3}{4}$ of an inch away from the firmly attached peritoneum then it exposes the very loose

connective tissue which does not contain large blood vessels. The latter extends between the dissecting forceps, which draws up the bladder and the uterine wall and is cut half way with scissors in the direction of the uterus. This leads to the right layer and later permits of the bladder being detached from the lower segment by blunt dissection.

The bloodless exposure of the lower segment prevents the formation of small hematomata in the connective tissue, gives a clear field for the operation and contributes to clean healing.

The next important point to be considered is the making of a longitudinal fold in the lower segment wall. This fold is held in position by clamping it with two Allis's forceps and making a small incision between them. The blood is thus prevented from flooding the incised surface and the liquor amnii is drawn off through this small opening and is almost entirely prevented from entering the peritoneal cavity. This is of importance if the liquor amnii is infected.

The conditions assured by this method facilitate the extension of the incision in the lower uterine segment. If, however, some bleeding should occur, it can easily be checked by clamping with Allis's forceps.

Finally it is of great importance to wait until the injection of pituitrin given into the active part of the uterus has contracted the uterine muscles well before removing the placenta. If the contraction is strong, pressure on the fundus of the uterus and slight pulling on the cord will completely separate the placenta and its extraction as well as that of the membranes becomes an easy matter. Manual removal or exploration of the cavity is thus avoided in most cases.

Furthermore, only slight bleeding, if any, occurs as the result of good contraction of the uterus due to the action of pituitrin injected into the active part of the uterine muscle in proper time.

My thanks are due to Professor R. W. Johnstone for criticism and advice.

Fibroids in Pregnancy

(An Analysis of 122 Cases Treated in University College Hospital, London, from 1934 to 1945.)

BY

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INCIDENCE.

SPENCER[1] said that fibroids occur about once in every 150 pregnancies, and this figure seems to be a fair average. Mussey and Hardwick[2] gave an incidence as high as 1.9 per cent and F. J. Browne[3] one as low as 0.28 per cent. However, it is hard to give an accurate estimate, for, although some intramural fibroids become superficial and thus more easily palpable as pregnancy advances, others become flattened and softer and progressively more difficult to feel. Pierson[4] noted 250 cases in 30,836 pregnancies (0.8 per cent), but regarded only 191 of them as of "clinical significance," whilst Mussey and Hardwick[2] thought that only 97 of their 297 cases were important. There is thus a wide variation of individual opinion in interpreting "clinical importance," and therefore the term is of little value.

In University College Hospital over the past 12 years the following incidence has been noted:

Number of pregnancies ...	15313
Number of cases with fibroids:	
Primigravidae	81
Multigravidae	41
Total	122
Incidence	0.79 per cent

Watson's[5] contention that parous women are less liable to develop fibroids is widely accepted, but no definite deductions can be made from these figures as more primigravidae than multigravidae have been treated in the hospital.

Age Incidence. The present series of cases show that this complication is found relatively frequently in elderly primigravidae. Spencer[6] said that he usually found one or more fibroids in primigravidae of 35 years and upwards, but this high incidence must be exceptional. Many of the patients here had been married for a number of years, a fact which suggests low fertility. Indeed, Graves[7] and Beckwith Whitehouse[8] both estimate that 30 per cent of women with fibroids are sterile.

Total cases	122
Number of primigravidae of 36 years of age or more	25 (20.5%)
Average age of *all* cases	34.3 years

The youngest patient was 25 and the eldest 46 years old.

EFFECT OF FIBROIDS ON PREGNANCY.

In this series of 122 cases, only 49 (40 per cent) had normal pregnancies, and this figure does not include toxaemia, the incidence of which was not increased, and malpresentations which were more common. Thirty-eight of the normal cases were primigravidae, and 11 were multigravidae.

Premature interruption of pregnancy.

It may be of interest to note that 15 out of 102 cases where records are available (14.7 per cent)—6 primigravidae and 9 multigravidae—gave a history of at least 1 miscarriage. In Watson's[5] series of 157 cases it occurred in 45 per cent, whilst Spencer[9] maintained that only submucous fibroids caused abortion, and these incidentally especially predispose to sterility.

Threatened abortion. (Where pregnancy continued).

Eleven cases were admitted, and 1 re-admitted to hospital with a threatened abortion (9.8 per cent). The bleeding took place at any time from very early pregnancy up to the 25th week, and in 9 patients it occurred after the 12th week.

Abortion (where pregnancy terminated before the end of the 28th week).

Seventeen patients miscarried (14 per cent), 10 of them after the 3rd month. Polak[10] found that 21 per cent of his patients aborted, and Pierson[4] 8 per cent.

In consideration of all the facts relative to the incidence of abortion it would be unwise to form any conclusions from these figures. One fact should be noted—the greatest proportion took place after the 12th week, a point emphasized by Pierson.[4]

Premature labour. This took place on 10 occasions (twice in a twin pregnancy), and 6 of the 12 infants were lost.

Of the 122 cases under consideration abortion took place in 17 patients and premature labour was noted in 10. Thus, premature interruption of pregnancy took place in 22.1 per cent of cases and the foetal mortality in them was 79.3 per cent. Pierson[4] gives a very similar figure—premature interruption of pregnancy took place in 39 cases (24.1 per cent) and the foetal mortality was 78.7 per cent.

Pressure symptoms. No attempt has been made to assess the relative importance of the fibroids in the causation of these symptoms. Only 1 patient had retention of urine. She was suffering from epilepsy which was increasing in severity, and a total hysterectomy was performed in the 3rd month after the urinary symptoms had been alleviated.

Impaction,[11] torsion of a pedicle,[12] infection, intraperitoneal bleeding from a ruptured vein,[13] ectopic pregnancy[14] and placenta praevia were not encountered.

Effect of Pregnancy on Fibroid.

Size. Fibroids become larger and softer as pregnancy advances owing to oedema, increased vascularity and hyperplasia and hypertrophy of the muscle fibres.

Displacement. The growing uterus tends to pull the fibroids upwards out of the pelvis, and, in the last 3 months of pregnancy, those sunk deep in the muscle may be more easily palpable as the uterine wall is thinned out. During labour, fibroids which at first sight appear to offer insuperable obstruction, may be drawn over the presenting part. No case was noted where this occurred, for when a fibroid was situated below the presenting part and appeared as if it might obstruct labour Caesarean section was carried out.

Red degeneration. Watson[5] regarded this as the most frequent complication, and the present series where it occurred in 22 patients (18 per cent), 19 of whom were admitted to hospital, confirms his view. It was met with at any time from the commencement of gestation until term—in fact one woman who was never ill enough to require hospitalization complained of local pain and tenderness throughout her pregnancy, and another had severe pain from this complication during labour and the first few days of the puerperium.

All cases, except 2, were treated conservatively. Laparotomies were performed on 4 occasions when the diagnosis was in doubt and the patient in great pain. In the 2 patients under consideration a myomectomy was done at the 12th and 18th week respectively, without disturbing the pregnancy. One was not delivered by the hospital and her subsequent history is unknown. The other had a forceps delivery of a healthy child at term. In the case of the other 2 patients, operative treatment was not undertaken.

Two explanations have been given for the more frequent incidence of red degeneration during pregnancy. Browne[3] suggests that the increased fibrinogen content of the blood in pregnancy favours thrombosis in the arteries supplying the fibroid with a consequent infarction, and Charlewood[15] that the increased growth of the fibroid under hormonic influence outstrips the blood supply, which may be further diminished by the tumour becoming exteriorized.

Antepartum Haemorrhage.

There were 5 cases of antepartum haemorrhage for which a cause could not be found (4.1 per cent). Bleeding took place between the 32nd and 38th week and in no case did it occur more than once. Two patients went into labour normally at term, Caesarean section was performed twice at the 35th and 38th week respectively, and the fifth patient had a breech delivery. The last child was lost.

From 1934 to 1945 a total of 410 patients were admitted to University College Hospital with antepartum haemorrhage (2.7 per cent). However, these figures are too small to allow of any deduction being made as to whether fibroids predispose to this complication.

Myomectomy.

This operation was attempted only 5 times. Two were performed for red degeneration, 2 for large fibroids (which had been diagnosed as ovarian cysts) and 1 on a fibroid which was thought likely to interfere with uterine growth later on.

Two patients had healthy babies delivered with forceps, one 5 weeks premature and the other at term. Another aborted one month after her operation and one (whose operation was done for necrobiosis) was not seen again after her discharge from hospital. The fifth bled so copiously at operation that it was necessary to perform a hysterotomy before the haemorrhage could be controlled.

The risk attached to the operation is about 0.5 per cent greater during pregnancy,[11] and its performance is rarely necessary. Watson[5] attempted it 3 times in 157 cases; 1 patient aborted, hysterotomy was necessary to control haemorrhage in a second, while a third went to term. Mussey and Hardwick[2] found that 12 of their 32 patients aborted and another died. Gemmell[16] collected 475 cases; 65 of these miscarried and 14 died.

Termination of Pregnancy.

Hysterectomy was performed in 6 cases before the foetus was viable. On 4 occasions the pregnancy had not been diagnosed, irregular bleeding, amenorrhoea in middle-aged women and an ovarian cyst all helping to obscure its presence. Severe epilepsy and psychological reasons necessitated the other 2 operations.

Another pregnancy was terminated for severe thyrotoxicosis. Reference has been made already to the occasion on which hysterotomy was necessary to control severe haemorrhage during a myomectomy.

Summary of Complications During Pregnancy.

Total number of cases 122.

	No. of cases	Per cent
Normal pregnancy	49	40
Threatened abortion	12	9.8
Abortion	17	14
Premature labour	10	8.2
Red degeneration	22	18
Antepartum haemorrhage ...	5	4.1
Myomectomy	5	4.1
Termination	8	6.6

Effects of Fibroids on Labour.

Of the 122 cases described above, 9 were not delivered by the hospital, 17 aborted and 8 were terminated. Of the remaining 88 cases, 50 had normal labours (57 per cent) although 7 of them were premature.

Primary Uterine Inertia. Eight cases (9.1 per cent).

Primary uterine inertia is defined here in an arbitrary manner as a first stage of labour lasting for more than 48 hours. It is possible that the prolongation of the first stage could have been due to other causes, such as rigid cervix, but these factors cannot be assessed from the case records.

Four cases had a primary uterine inertia in this sense and were later delivered normally, and 3 cases were delivered by Caesarean section after a similar time. Another patient was treated by Caesarean section as the membranes had ruptured 36 hours before, and she had weak pains.

Second Stage of Labour Lasting 3 Hours or More.

This complication was found in 8 patients (9.1 per cent), and no case was caused by an obstructing fibroid.

Pierson[4] notes "inertia" in 34.6 per cent of cases and "prolonged labour" in 16.8 per cent, but he does not define these terms. However, in the present series it will be noted that 18 Caesarean sections in addition to those 4 cases noted were performed for various reasons (22 in all, or 25 per cent). It is possible a certain proportion of them would have developed inertia if they had been allowed to go through a normal labour. In Pierson's series the incidence of Caesarean section was only 14.6 per cent.

Forceps Deliveries.

It was necessary to extract 11 infants with forceps (12.5 per cent). Delay in the second stage, myomectomy during pregnancy and "deep transverse arrest" were the indications for their use.

A forceps delivery was necessary in 20 of the 101 patients recorded by Pierson[4] (20 per cent).

Caesarean Section.

Twenty-two patients were delivered by Caesarean section (25 per cent) and this figure resembles that recorded by Watson,[5] 35 operations in 157 patients (22.3 per cent). The most frequent indications were the patients' age, uterine inertia, an unfavourable presentation and an obstructing fibroid, but on one occasion an antepartum haemorrhage, twice a pre-eclampsia, once an ovarian cyst and once foetal distress in the first stage of labour added to this list.

During the operation, myomectomy was performed on 4 occasions, a procedure condemned by Browne[3] (except under certain circumstances), and a hysterectomy once.

Postpartum Haemorrhage (a vaginal loss of more than 20 ounces of blood).

Of the 66 patients who were delivered *per vaginam*, 2 patients had postpartum haemorrhage (3 per cent), and 1 manual removal of placenta was necessary (1.5 per cent). Pierson[4] has a far more gloomy

story to tell, 33.6 per cent of his patients having had postpartum haemorrhage. Polak[10] also noted a high incidence of haemorrhage, which occurred in 25 per cent of the cases he collected. Harris[17] thought haemorrhage was likely to occur only if the placenta were implanted over the fibroid, which might thus interfere with placental separation and uterine retraction. Watson had only 3 cases in his series of 157 (1.9 per cent), and two adherent placentae (1.3 per cent).

Malpresentations.

There were 6 breech (1 in a twin pregnancy) and 2 shoulder presentations at term. This is a very low incidence of malpresentation compared with other records.

Craniotomy.

One patient was admitted as an emergency in the second stage of labour. She was febrile, the foetus was dead, and a fibroid obstructed its delivery. A craniotomy was performed and the child extracted but the patient died about 6 weeks later. Munro Kerr[11] condemns dragging a child past an obstructing fibroid, but the alternative abdominal approach was thought to carry an even greater risk.

Puerperium.

Morbidity was noted in 7 patients, but in only 2 instances could the temperature be attributed to the presence of the fibroids—1 was due to red degeneration, and the other to a sloughing submucous fibroid.

Nearly all fibroids tend to diminish after delivery to their original size. Some authorities think that they may become smaller than before or even disappear, and they suggest that this phenomenon follows degeneration with liquefaction during pregnancy, and subsequent absorption of the fluid. One patient in University College Hospital was found to have fibroids in 2 pregnancies, but no evidence of their presence was found in a third. However, Munro Kerr[11] and F. J. Browne[3] both doubt whether fibroids disappear completely.

Involution is said to be slower and the lochia to persist longer. Records were not available to confirm these findings.

One case of sloughing fibroids has been described already. Uterine inversion was not encountered. Spencer recorded this accident.[18]

Maternal Deaths.

Three of the patients died, 1 from postoperative shock following a Caesarean section, 1 from a paralytic ileus 3 days after a Caesarean section and myomectomy, and the other from a terminal bronchopneumonia complicated by a vesicovaginal fistula and sloughing fibroids after craniotomy.

Summary of Complications During Labour.

Total number of cases 88.

	No. of cases	Per cent
Prolonged 1st stage of labour ...	8	9.1
Prolonged 2nd stage of labour ...	8	9,1
Forceps deliveries	11	12.5
Caesarean section	17	19.3
Caesarean section and myomectomy	4	4.5
Caesarean section and hysterectomy	1	1.1
Post-partum haemorrhage* ...	2	3.0
Manual removal of placenta* ...	1	1.5
Craniotomy*	1	1.5

* Only 66 patients were delivered *per vaginam*

Infant Report.

Eighty children were discharged healthy from the hospital, one set of twins included.

Ten children were lost for the following reasons:

1. Five infants were born macerated. This figure includes another set of twins born in the 30th week.

2. One dead birth—it showed no signs of life after a premature labour complicated by a prolapsed cord in the 29th week.

3. Two stillbirths, where the cord was pulsating, but no attempts at respiration took place, occurred. One followed a manual dilatation of the cervix and forceps delivery for a prolonged first stage of labour, and the other a breech extraction.

4. There were 2 neonatal deaths. One followed a premature labour at the 28th week, and the other a forceps delivery following a prolapsed cord in the 34th week.

A number of authorities have pointed to the high foetal mortality-rate. Pierson[4] recorded one of 35.6 per cent, and Mussey and Hardwick[2] one of 28.9 per cent, but only 6.6 per cent where the child was viable. In his 157 cases, Watson[5] found 18 stillbirths and 2 intra-uterine deaths (12.7 per cent).

2. The incidence was 0.79 per cent, and the average age was 34.3 years.

3. More than 20 per cent of the patients were primigravidae of 36 years of age or more.

4. Pregnancy was normal in only 40 per cent of patients. The abnormalities have been described.

5. Labour was uncomplicated in 57 per cent of the cases and operative interference was frequently necessary; 12.5 per cent of the infants were extracted with forceps; Caesarean section was performed in 25 per cent of cases and craniotomy once.

6. The incidence of uterine inertia, although far greater than in unselected cases, was a less frequent complication than might have been expected from a study of other records.

7. Two cases only of morbidity could be attributed to the presence of fibroids.

8. There were 3 maternal deaths all resulting from operative interference.

Summary of Foetal Mortality.

The stillbirth and neonatal death-rate was 11.1 per cent.

(The stillbirth and neonatal death-rate for all cases delivered by the hospital from 1935 to 1945 was 6.5 per cent.)

Total number of pregnancies	No. of healthy children born	Percentage of children lost (Abortions, stillbirths and neonatal deaths)
122−9*=113 (Two twin pregnancies included)	80 =69.6 per cent	30.4 per cent

* Nine patients not delivered by hospital.

Summary.

1. One hundred and twenty-two cases of fibroids in pregnancy have been described, and their complications compared with those found by other observers.

9. Of the 113 patients who were looked after by the hospital, 79 only had healthy children. A large number aborted (14 per cent) and the foetal and neonatal death-rate was 11.1 per cent.

Conclusions.

1. The frequency of complications in pregnancy, labour and puerperium, and the high foetal and maternal death-rate show that the presence of fibroids is a serious complication.

2. Red degeneration during pregnancy should be treated conservatively and myomectomy should, if possible, be avoided.

3. Caesarean section will usually secure a living child, and it should be seriously considered in all elderly primigravidae and all other patients where there is an additional complication.

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A Statistical Study on the Effects of Exercises on Childbearing

BY

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INTRODUCTION.

THE object of this study was to determine what apparent effect the regular practice of special exercises during pregnancy had upon the patient during her confinement, and how the labour of exercise patients compared with that of a group of controls. The material used for this study consisted of the case notes of 340 primiparous women who had received regular instruction in prenatal and labour exercises from the 16th to the 20th week to the end of the end of the pregnancy and a control group of 340 primiparous women who had not received such special instruction nor practised special exercises. Patients included in this study attended classes at the antenatal clinic at intervals of 2 weeks and practised the exercises at home.

In labour, the patients attempted to carry out the exercises they were taught during pregnancy, but there was no supervision by the physiotherapist. The midwives responsible for the supervision of the patients were able to spend very little time with them during the first stage of labour, with the result that the benefit of antenatal preparation of the patient for labour was not felt as much as had been hoped.

The special postures advocated by some teachers of labour exercises were not taken up by patients in the series of cases studied. In cases of normal labour patients were encouraged to walk about during the first stage of labour; in the second stage the dorsal position was adopted and for delivery the left lateral position.

OBSERVATIONS ON THE PURPOSE AND PRACTICE OF PRENATAL AND LABOUR EXERCISES.

During pregnancy and labour the structures of the body, particularly the muscles of the abdomen and spine and the joints and ligaments of the pelvis and the tissues of the pelvic floor are subjected to considerable strain, and as a result many women are left with disabilities which cause much discomfort and ill-health. It appears that at least some of the disabilities following childbirth might be avoided if there was a greater appreciation of the mechanics of the body and a better understanding by the patient of muscle control and co-ordination of movement and of the principle of mental and physical relaxation.

Little attention has so far been given to the study of the mechanics of the body in pregnancy and labour, but considerable attention is now being given to the subject of educating the expectant mother in the control and use of her muscular system, and great eagerness is usually shown by her in practising what she is taught, because she believes that her labour will be made easier by such practice.

Prenatal exercises and exercises for the confinement are now taught at many clinics of maternity units and hospitals and also in private midwifery practice. Those responsible for the training are usually physiotherapists who have themselves undergone special training in maternity exercises. The systems practised show

surprising variations and not all exercises taught and practised have a scientific basis. The frequency of the instruction is often not sufficient to ensure that the patient has mastered the principle of the exercises before she goes into labour and in such cases the cause of labour may be hindered rather than helped.

Purpose of the Exercises.

Prenatal Exercises.

The object of these exercises is

(*a*) To teach the expectant mother the basic principles of muscle control, of mental and physical relaxation and how to use her muscles effectively in her daily work, exercise and labour.

(*b*) To help her to adopt and maintain a good posture during pregnancy as the size and weight of the uterus increases, and to lessen the fatigue and backache usually associated with increasing lordosis.

(*c*) To improve the circulation and muscle tone, by the practice of deep breathing exercises and special exercises for the spinal, abdominal and pelvic floor muscles.

(*d*) To increase the flexibility of the pelvic joints.

Exercises for the Confinement.

These have been designed with the object of shortening labour, lessening fatigue and aiding natural childbirth.

For the first stage of labour the basic principle of teaching is muscular relaxation

Table I. Investigation of Labour.

An Analysis of the Case Notes of 340 Exercise Patients and 340 Control Patients.

Type of Labour.

	Exercise cases		Control cases					Exercise cases		Control cases	
	No.	Per cent	No.	Per cent	Presentation	Delivery	Third stage	No.	Per cent	No.	Per cent
Normal labour	253	74.4	245	72.1							
Abnormal labour	69	20.3	81	23.8	1. Vertex	Spontaneous	Recorded haemorrhage 20 ounces or over	23	33.3	36	44.4
					2. Vertex	Forceps	Normal	29	42.0	27	33.3
					3. Vertex	Forceps	Recorded haemorrhage 20 ounces or over	9	13.0	9	11.1
					4. Breech	Assisted	Normal	8	11.6	8	9.9
					5. Face	Spontaneous	Recorded haemorrhage 20 ounces or over	—	—	1	1.2
Premature labour	18	5.3	14	4.1							
Total	340	100.0	340	100.0			Totals	69	99.9	81	99.9

particularly during the phase of uterine contractions.

For the second stage the patient is taught: (*a*) to make effective use of her abdominal muscles and muscles of the diaphragm, to aid the expulsive contractions of the uterus, (*b*) to practise relaxation between uterine contractions in order to lessen the tendency to fatigue, (*c*) and to relax the muscles of the pelvic floor to ease the birth of the child. Another feature of the exercises, regarded as of first importance by some teachers, is the adoption of a special posture such as squatting, crouching or kneeling during labour and delivery. These primitive postures are not generally liked by midwives or mothers in this country who prefer the dorsal or left lateral position for childbirth, and for this reason the special postures have not been accepted in many of the teaching centres.

It will be seen from Table I that for the exercise group of 340 patients, labour was normal in 253 cases, or 74.4 per cent of the total; abnormal in 69, or 20.3 per cent; and premature in 18, or 5.3 per cent—2 of the latter group being the result of induction of labour.

In the control group of 340 patients, labour was normal in 245 cases, or 72.1 per cent of the total; abnormal in 81, or 23.8 per cent; and premature in 14, or 4.1 per cent.

The analysis shows approximately the same proportion of cases of normal, abnormal and premature labour in both the exercise and control groups.

Presentation in Labour.

(*a*) *Vertex presentation.* There were 314 or 97.5 per cent of cases of vertex presentation for the exercise group of 322 cases and 317, or 97.2 per cent for the 326 controls.

(*b*) *Breech presentation.* There were 8 cases of breech presentation in the 26 to 30 age group of the exercise cases and in addition 4 others in the over 30 age group in which version was performed between the 34th and 36th week of pregnancy—making a total of 12, or 3.7 per cent relative to the group total of 322.

In the control group there were 8 cases of breech presentation, 7 of which were in the 26 to 30 age group, and 3 others in which version was performed, making a total of 11, or 3.4 per cent relative to the group total of 326.

The presentation in late pregnancy and labour showed the same proportion of vertex presentations in both groups.

Details of Labour.

Spontaneous delivery.

Of the 314 exercise cases in which the vertex was presenting, there were 276, or 87.9 per cent of cases in which spontaneous delivery resulted, and of the 317 control cases 281, or 88.6 per cent.

The average duration of labour was about the same for the exercise and control groups of all ages (Table II).

Variations in the Duration of Labour in Cases of Vertex Presentation and of Spontaneous Delivery at or Near Term.

(*a*) 276 exercise cases; (*b*) 281 control cases.

Labour not Exceeding 24 hours.

In the exercise age group up to 30 years there were 172, or 78.9 per cent of cases in which the duration of labour did not exceed 24 hours and among the controls 154, or 70.9 per cent out of 217 cases. In the older groups of 31 years and above, there were 42, that is 72.4 per cent, out of a total of 58 exercise cases and 40, that is 62.5 per cent, out of a total of 64 cases.

TABLE II. AVERAGE DURATION OF LABOUR IN CASES OF VERTEX PRESENTATION AND OF SPONTANEOUS DELIVERY AT OR NEAR TERM.

(a) 276 Exercise Cases. (b) 281 Control Cases.

Age group	Group	No. of cases	Stages of labour: First Hr.	First Min.	Second Hr.	Second Min.	Third Hr.	Third Min.	Total Hr.	Total Min.
20 years and under	(a) Exercise	11	23	9	1	1	–	21	24	31
	(b) Control	11	17	31	–	56	–	19	18	46
21 to 25 years	(a) Exercise	95	17	48	1	19	–	21	19	28
	(b) Control	98	15	54	1	24	–	20	17	38
26 to 30 years	(a) Exercise	112	20	49	1	31	–	20	22	40
	(b) Control	108	21	5	1	37	–	24	23	6
31 to 35 years	(a) Exercise	52	17	47	1	41	–	21	19	49
	(b) Control	56	23	24	1	41	–	21	25	26
36 years and over	(a) Exercise	6	20	33	1	15	–	23	22	11
	(b) Control	8	19	41	1	59	–	21	22	1
All ages	(a) Exercise	276	20	1	1	21	–	21	21	44
	(b) Control	281	19	31	1	31	–	21	21	24

For all ages the figures were 214, that is 77.5 per cent, out of a total of 276 cases and for the controls 194, that is 69 per cent, out of a total of 281 cases.

The difference of 8 per cent more exercise cases than controls with labour not exceeding 24 hours for the 30 years and under group; 9.9 per cent for the 31 years and over age group; and 8.5 per cent more for all ages, certainly is a slight advantage to the exercise cases, but the figure is not large enough to be of significance.

ABNORMAL LABOUR.

FORCEPS DELIVERY.

There were 38, or 12.1 per cent of cases of forceps delivery relative to the 314 cases of vertex presentation at or near term in the exercise group and 36, or 11.4 per cent among the 317 controls.

The average total duration of labour was about the same in both exercise and control groups; it was considerably longer than for those cases where delivery was sponta-

TABLE III. AVERAGE DURATION OF LABOUR. FORCEPS DELIVERY.

(a) 38 Exercise cases; (b) 36 Control Cases at or Near Term.

Group	No. of cases	Stages of labour: First Hr.	First Min.	Second Hr.	Second Min.	Third Hr.	Third Min.	Total Hr.	Total Min.
(a) Exercise ...	38	36	11	3	17	–	24	39	52
(b) Control ...	36	37	39	3	34	–	25	41	38

neous. For the exercise group it was 39 hours 52 minutes and for the controls 41 hours 38 minutes compared with 21 hours 44 minutes and 21 hours 24 minutes for cases of spontaneous delivery, showing a difference of 18 hours 8 minutes for the exercise group and 20 hours 14 minutes for the controls (Table III).

There was a difference of 1 hour 46 minutes between the total duration of labour in cases of forceps delivery for both groups.

account of delay due to mechanical difficulties and weak uterine contractions, and in 31 or a ratio of 82.6 per cent of the 36 controls (Table IV).

Cases of Breech Presentation.

The number of cases of breech presentation at or near term was 8, or 2.5 per cent of the total of 322 exercise cases and 8, or 2.5 per cent of the 326 controls. In 4 other exercise cases version had been performed

Table IV. Abnormal Labour. Forceps Delivery.
Indications for the use of Forceps in Cases of Vertex Delivery at or Near Term.

Indications	Exercise cases		Control cases	
	Number	Percentage	Number	Percentage
Foetal distress	2	5.3	3	8.3
Cardiac condition	1	2.6	2	5.5
Mechanical difficulties:				
(*a*) Vaginal septum	1	2.6	–	–
(*b*) Disporportion—anterior position of foetus	4	10.5	6	16.6
(*c*) Posterior position of foetus...	12	31.6	11	30.6
(*d*) Deep transverse arrest of foetal head.	11	29.0	5	14.0
Weak uterine contractions anterior position of foetus	7	18.4	9	25.0
Totals	38	100.0	36	100.0

A record of the position of the foetus was, in most cases, made after abdominal examination when the patient was admitted in labour, but in a number of cases the position was not determined. On this account we do not know in how many cases partial or complete rotation of the head had taken place.

The list of indications for the use of forceps is not really helpful, for the added factors of weak uterine contractions and disproportion contributed to delay in a number of the cases of posterior and lateral position of the foetus.

In 35 or a ratio of 92.1 per cent of the 38 exercise cases, forceps were applied on

between the 34th and 36th week of pregnancy and in 3 of the control cases. It appears probable that for the exercise group there would have been 12, or 3.7 per cent of cases of breech presentation and for the controls 11, or 3.4 per cent (Table V).

There is no indication that the practice of the special exercises had an effect on the presentation in late pregnancy.

The average total duration of labour was 14 hours 55 minutes for the exercise group of 8 cases of breech presentation and 19 hours 14 minutes for the controls.

In none of the exercise cases did labour exceed 24 hours, but in 3 of the controls it exceed 36 hours.

TABLE V. CASES OF BREECH DELIVERY AT OR NEAR TERM.
AVERAGE DURATION OF LABOUR.
(a) 8 Exercise Cases; (b) 8 Control Cases.

Group	No. of cases	Stages of labour: First Hr.	First Min.	Second Hr.	Second Min.	Third Hr.	Third Min.	Total Hr.	Total Min.
(a) Exercise ...	8	12	54	1	41	–	19	14	55
(b) Control ...	8	17	14	1	33	–	27	19	14

PREMATURE LABOUR.

The number of cases of premature labour was 18, or 5.3 per cent relative to the total of 340 cases in the exercise group and 14, or 4.1 per cent of the 340 in the control group. Among the exercise cases there were 2 of induced labour for pre-eclamptic toxaemia; one case of toxaemia not induced; 2 of hyperpiesis; and 1 of twins. Among the control cases there were 2 of pre-eclamptic toxaemia; 1 of lateral placenta praevia; 1 of influenza preceding the onset of labour; and 5 of twins. Control of labour was not induced in any of the cases. No cause was found for the onset of premature labour in the remaining 8 exercise and 5 control cases.

There is no difference in the incidence of prematurity in the 2 groups.

PREMATURE BIRTHS.

FOETAL AND INFANT MORTALITY.

In the exercise group of premature births there were 3 stillbirths, one due to a toxaemic condition of the mother, another was a result of a complication of labour and the third a hydrocephalic foetus weighing 1 pound 12 ounces. In the control group there were 4 stillbirths—one due to a toxaemic condition of the mother, another to a true knot in the umbilical cord and 2 twins for whom the cause of foetal death was not known.

SEDATIVES AND ANALGESICS. ADMINISTERED DURING LABOUR.

Sedatives and analgesic drugs administered during the first stage of labour were potassium bromide, chloral hydrate, tincture of opium and morphine sulphate.

In the exercise group of patients, 1 or more of these drugs in single or repeated doses were given to 171, that is 50.3 per cent of patients and in the control group to 146, that is 42.6 per cent. The analgesic

TABLE VI. AVERAGE DURATION OF PREMATURE LABOUR.
(a) 18 Exercise Cases; (b) 14 Control Cases.

Group	No. of cases	Stages of labour: First Hr.	First Min.	Second Hr.	Second Min.	Third Hr.	Third Min.	Total Hr.	Total Min.
(a) Exercise ...	18	18	34	1	5	–	15	19	55
(b) Control ...	14	12	8	1	52	–	20	14	20

The average total duration of premature labour in the 18 exercise cases was 19 hours 55 minutes and for the controls 14 hours 20 minutes. In 2 cases of twins and 3 other cases in the exercise group, labour exceeded 24 hours, and in 2 cases of twins and 1 other in the control group (Table VI).

drugs, tincture of opium and morphine, were administered in 15 per cent of cases in both groups.

In the second stage of labour gas and air analgesia was administered for all normal cases where conditions were suitable and the length of the second stage allowed for its administration, except in a rare case in both the exercise and control groups where the patient expressed the wish not to have the analgesia administered so that she might be assured that she was co-operating fully in the birth of her baby.

There was no evidence that labour was less painful for those patients who had practised the exercises than for those who had not done so.

Postpartum Haemorrhage.

Among the exercise group of 276 cases of vertex presentation with spontaneous delivery, there were 23, or 8.3 per cent in which postpartum haemorrhage of 20 ounces or more was recorded and in the control group of 281 cases there were 36, or 12.8 per cent.

Among the 38 exercise cases delivered by forceps, there were 9, or 23.7 per cent in which postpartum haemorrhage of 20 ounces or more was recorded and in the control group of 36 cases 9, or 25 per cent.

In the premature group of exercise cases, 3 cases of excessive haemorrhage were recorded and in the control group 2 cases. Of these, 2 in both groups were cases of twins.

Perineal Lacerations.

(*a*) 276 exercise cases; (*b*) 281 control cases.

Among the 276 cases of vertex presentation with spontaneous delivery at or near term, there were 166, or 60 per cent of cases with perineal lacerations in the exercise group and 158, or 56.2 per cent in the control group.

Episiotomy was performed in 2 of the exercises cases and 6 of the controls of the under 30 age groups.

Average Birth-Weight of Infants.

For the exercise group of 322 cases delivered at or near term, the average birth-weight for the male infants was 7 pounds 7 ounces, and for the females 7 pounds 2 ounces. For the control group of 326 cases the average birth-weight for the male infant was 7 pounds 6 ounces and for the female 7 pounds 3 ounces. The average weight in both groups for male and female was 7 pounds 4½ ounces.

The average birth-weight of the premature infants in the 18 exercise cases was 4 pounds 9 ounces for the male infants and for the females 4 pounds 14 ounces. For the control group the average weight of the males was 5 pounds 1 ounce, and for the females 4 pounds 10 ounces. The average for males and females in both groups was 4 pounds 11½ ounces, and 4 pounds 9½ ounces for the controls.

Foetal and Infant Mortality.

Among the exercise group of 322 cases delivered at or near term, there were 8, or 2.4 per cent stillbirths and 1 infant death. Two of the stillbirths were associated with hydrocephaly, 1 with toxaemia of the mother, another was due to a congenital heart lesion; 3 were the result of complications of labour and in 1 case the cause was not known. The infant death was due to atelectasis.

In the control group of 326 cases, there were 7 or 2.2 per cent stillbirths, 3 of which were due to complications of labour; 1 other due to haemolytic disease; and in 2 cases the cause was not known.

There were 2 infant deaths, 1 due to cerebral haemorrhage following a breech delivery and the other to congenital malformation of the heart.

The total number of stillbirths, including the 3 premature stillbirths, was for the exercise group 11, or 3.2 per cent of 344 births and for the control group of 345 births 12, or 3.4 per cent, including the 4 premature births.

Summary and Conclusions.

1. An analytical study has been made of the obstetric case notes of 340 primiparous women who had received instruction in maternity exercises and of a comparative group of controls.

2. *Type of labour.* The cases were divided into 3 groups, those of normal labour, abnormal and premature labour.

In the exercise group there were 253, or 74.4 per cent of cases of normal labour, 69, or 20.3 per cent of abnormal and 18, or 5.3 per cent of cases of premature labour. For the controls there were 245, or 72.1 per cent of cases of normal labour, 81, or 23.8 per cent of abnormal and 14, or 4.1 per cent of cases of premature labour.

(In the exercise group 2 of the cases of premature labour were the result of induction.)

The proportion of cases in each group is approximately equal for both exercise and control cases.

3. *Presentation.* There were 314, or 97.5 per cent of cases of vertex presentation for the exercise group of 322 cases, and 317, or 97.2 per cent for the 326 controls, and 8, or 2.5 per cent of cases of breech presentation for both groups.

4. *Delivery.* Spontaneous delivery occurred in 276, or 87.9 per cent of the 314 cases in the exercise group, and in 281, or 88.6 per cent of the 317 cases in the control group.

5. The average duration of labour in cases of vertex presentation and of spontaneous delivery at or near term was for the 276 exercise cases 21 hours 44 minutes, and for 281 control cases, 21 hours 24 minutes.

6. The number of cases in the above 2 groups in which labour did not exceed 24 hours was, for the exercise cases, 214, or 77.5 per cent, and for the controls 194, or 69 per cent.

The slight difference of 8.5 per cent more cases for the exercise group is not enough to be regarded as a significant figure.

7. *Forceps delivery.* The number of cases of forceps delivery was 38, or 12.1 per cent relative to the 314 exercise cases of vertex presentation and 36, or 11.4 per cent of the 317 controls.

8. The average duration of labour in cases resulting in forceps delivery was 39 hours 52 minutes in the exercise group and 41 hours 38 minutes in the control group. This was 18 hours 8 minutes longer than for cases of spontaneous delivery for the exercise cases and 20 hours 14 minutes longer for the controls.

9. *Indication for the use of forceps.* In 35, or a ratio of 92.1 per cent of 38 exercise cases, forceps were applied on account of delay due to mechanical difficulties and weak uterine contractions and in 31, or a ratio of 86.2 per cent of the 36 controls.

10. *Breech presentation.* Among the exercise group there were 8, or 2.5 per cent in the 322 exercise group, and the same number among the controls. (Version had been performed in 4 other exercise cases and 3 controls.)

11. *Premature labour.* The number of cases of premature labour was 18, or 5.3 per cent relative to the total of 340 exercise cases and 14, or 4.1 per cent for the controls. (Among the exercise cases there were 2 of induced labour.)

12. The average duration of premature labour was 19 hours 55 minutes for the

exercise group and 14 hours 20 minutes for the controls. This is an appreciable difference in favour of the controls, but the number of cases is so small that it would be erroneous to regard the figure as of any significance.

13. *Premature stillbirths.* There were 3 in the exercise group and 4 among the control group.

14. *Sedatives and analgesia.* These were administered in 171, or 50.3 per cent of exercise cases and 146, or 42.6 per cent of controls. Analgesic drugs were given in 15 per cent of cases in both groups. Gas air analgesia was given to almost all the patients in both groups.

15. *Postpartum haemorrhage.* Among the exercise group there were 23, or 8.3 per cent of recorded cases of postpartum haemorrhage in the exercise group of 276 cases of spontaneous delivery, and 36 or 12.8 per cent among the control group of 281.

16. *Perineal lacerations.* Among the 276 exercise cases of spontaneous delivery there were 166, or 60 per cent with perineal lacerations and among the 281 controls 158, or 56.2 per cent.

17. *Average birth-weight of infants.* This was 7 pounds $4\frac{1}{2}$ ounces for both exercise and control groups.

18. *Foetal and infant mortality.* The number of stillbirths among the exercise group of 322 cases delivered at or near term was 8, or 2.4 per cent, compared with 7, or 2.2 per cent of the 326 cases among the control group. There was 1 infant death in the exercise group and 2 in the control group.

This detailed study has not revealed any appreciable difference between the exercise and control groups for the type of labour, presentation, average duration of labour, for postpartum haemorrhage and perineal lacerations, for the average weight of infants and infant mortality rates. There is no indication from this analysis that labour was less painful for the exercise cases than for the controls.

It appears that the infrequency of the instruction and the lack of supervision in labour by a trained instructress lessened the value of the antenatal training.

More trained persons are needed before the value of maternity exercises in preparation for childbirth can be properly assessed. This aspect of antenatal work can only be fully developed when all midwives and pupil midwives are trained in the principles of the exercises; understand the objects of their practice and encourage the patient to carry them out during pregnancy and labour.

Timing of Endometrial Biopsy

BY

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IN the investigation of sterile matings the problem of when best to collect a fragment of endometrium for biopsy is a real one. Obviously to obtain a fair estimate of the full degree of progestational development reached by the endometrium the nearer to the onset of menstruation the material for biopsy is obtained the better, though much of interest can be learnt from biopsies taken at earlier stages in the cycle. There is always a difficulty, considerable in private, and greater still in clinic or hospital practice, when there may be only 1 or 2 days in a week to choose from, in estimating on what date to arrange an appointment for this examination. This particularly applies to patients with irregular cycles. One solution is deliberately to give a rather too early appointment telling the patient to return each week for another biopsy until menstruation starts. An alternative method of attempting to surmount the difficulty is to see the patient immediately after the onset of menstruation; but this, which entails an appointment at short notice, is by no means convenient to arrange in a busy private or hospital practice; moreover, many women dislike being examined and subjected to any extra discomfort during a period. Those who advocate doing a biopsy on the 1st day of menstruation claim the added advantage that there is no danger of disturbing a possible conception. This fear, far from being confirmed, has, in my experience been very largely removed by the not uncommon observation that patients fail to report another period after the taking of endometrium for biopsy. It seems indeed that this procedure tends in certain cases to encourage successful embedding rather than to disturb the early embryo.

In a series of some 850 subfertile matings this absence of subsequent menstruation has now been noted in at least 35 cases where follow-up has been possible. These cases are summarized in Table I, together with 1 case that can be classified as fertile. With the exception of this case all these patients came for advice because of difficulty in conceiving or carrying a pregnancy to term. All the biopsies were obtained without anaesthesia in clinic or consulting room. The average age of the 35 subfecund women was 30 years (youngest 19 years, oldest 41 years); they had, on an average, been trying to become pregnant for 2 years (shortest time 3 months, longest 4½ years) before being seen; 19 had not had a previous pregnancy; 5 had each had 1 child born alive; 2 had had 1 live birth and 2 miscarriages; 1 had had 1 stillbirth and 1 child born alive; 1 had had 1 stillbirth; 1 had had a stillborn infant and 2 miscarriages; 2 had had 1 miscarriage; 2 had had 2 miscarriages; 1 had 3 and 1 had 4 miscarriages. The remaining patient, who was not infertile, had had 1 live birth previously. In 17 of the infertile cases, except for routine pelvic examination,

FIG. 1

CASE 20. 11th day of cycle. Subnuclear vacuolation seen. × 100

FIG. 2

CASE 27. 23rd day of cycle. Changes correspond to later date. × 100

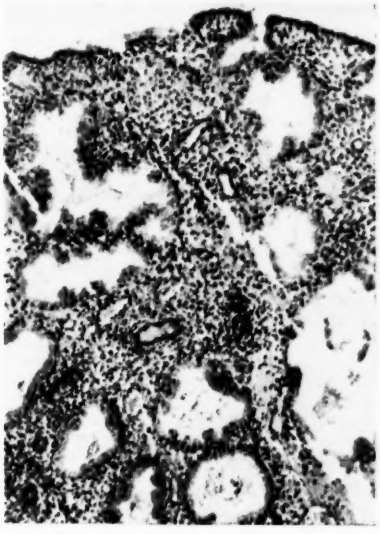

FIG. 3

CASE 31. 24th day of cycle. Advanced changes. × 100

M. H.-J.

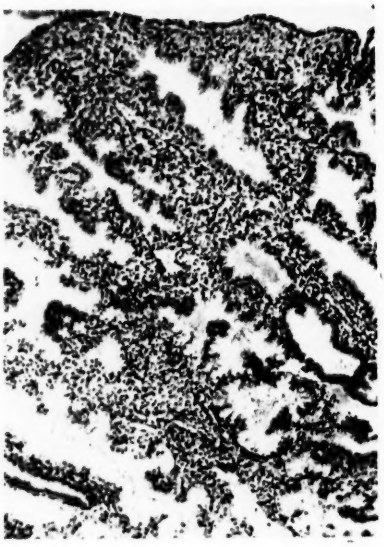

FIG. 4

CASE 28. 25th day of cycle. Advanced changes. × 100

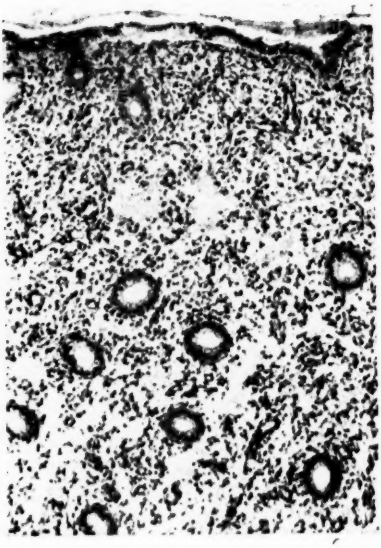

FIG. 5

CASE 21. 14th day of cycle. Changes delayed. × 100

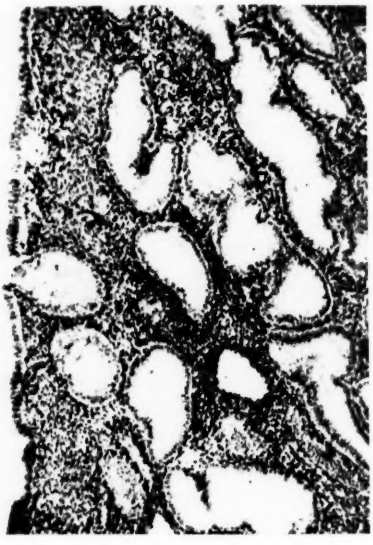

FIG. 6

CASE 4. 25th day of cycle. Changes delayed. × 100

M. H.-J.

endometrial biopsy was the only procedure carried out and no treatment was given before the cycle in which pregnancy occurred. In 14 cases a tubal insufflation had been done either before, or at the same time as the critical biopsy and 5 of these and the 4 remaining infertile patients had received treatment of one sort or another (endocrines, pelvic diathermy, cauterization of the cervix, etc.) before the cycle in which the critical biopsy was done. Thirty-seven biopsies are included in the series, as in 1 case a biopsy was taken on two occasions in the same cycle as that in which conception occurred. Seven of the biopsies were done before the 14th day, that is in the first half of the cycle and most probably before ovulation had occurred; 30 were taken on or after the 14th day of the cycle and 18 of these between the 25th and 35th day, therefore probably after embedding had started. The microscopical appearance corresponded on the whole with what would be expected for the days in the cycle when the biopsies were taken, except in a few cases where the stage of development was either rather more or less advanced than might have been expected. For example, the biopsy taken on the 11th day of the cycle in case 20 (Fig. 1) shows some subnuclear vacuolation, and in those taken on 23rd, 24th and 25th days in cases 27 (Fig. 2), 31 (Fig. 3), and 28 (Fig. 4) the glands are markedly tortuous, secretion is plentiful and there is some pre-decidual change in the stroma; in fact, these 3 sections are comparable to some of those taken more than a week later. On the other hand, the biopsies taken on the 14th and 25th days in cases 21 (Fig. 5) and 4 (Fig. 6) are apparently at least a week behind in their development.

It may be noted that the greatest variations in degree of development is found in those biopsies taken between the 21st and 26th days of the cycle.

Of the 36 pregnancies which started in the cycles when these biopsies were obtained, 22 are known to have gone to full time with the delivery of normal, living infants (13 male, 8 female and 1 sex unrecorded); 1 ended prematurely with the delivery of a macerated female foetus; 4 ended in spontaneous miscarriages at between 2 and 5 months; 8 are at present pregnant; and 1 pregnancy was terminated for medical reasons at 2½ months. The last case is the only one that can be described as fully fertile; the biopsy was done for diagnostic purposes on the 34th day of the cycle and revealed a full blown (pro)gestational endometrium; the pregnancy continued uninterrupted, but unfortunately the patient's condition necessitated therapeutic abortion. The case that produced a macerated foetus at 8 months had had 2 previous miscarriages at 2½ and 3 months and subsequently achieved a slightly premature live infant. Of the cases that miscarried between 2 and 5 months, 2 had not previously been pregnant in spite of having practised coitus without contraception for more than a year, and both subsequently conceived again with very little trouble and have been delivered of full-time live infants. The 2 remaining cases had previously had 3 and 4 miscarriages each and on this occasion carried farther than they had in any of those previous pregnancies; 1 had an attack of influenza and bronchitis with considerable pyrexia and treatment with sulphanilamide just before she miscarried; the other developed a toxaemia which progressed in spite of treatment and ended with the expulsion of a slightly macerated foetus at the 5th month.

Whether one must regard the occurrence of pregnancy following upon the taking of endometrium for biopsy in all these 35 subfecund women as purely fortuitous is a moot point. The well-recognized pheno-

TABLE I.

Case	Age	Years married Yrs.	Years married Mths.	No contraceptives used before seeking advice Yrs.	No contraceptives used before seeking advice Mths.	Previous pregnancies	Dates of L.M.P.	Dates of Biopsy	Day in cycle	Histology	Tubal insufflation	Treatment before date of biopsy	Result
1	35	1	0	1	0	0	13.8.41	10.9.41	29	Secretory late			L.B. ♂ 25.5.42
2	35	5	0	4	6	0	15.10.41	24.10.41	10	Follicular	Yes		L.B. ♂ 10.8.42
3	34	5	0	2	0	0	20.9.42	25.9.42	6	Follicular	Yes	Yes	Misc. 3 months 7.11.42
4	22	3	8	3	6	0	21.12.42	15.1.43	25	Secretory mid			L.B. 3.10.43
5	25	1	6	0	8	0	14.2.43	11.3.43	25	Secretory mid	Yes	Yes	L.B. ♂ 22.11.43
6	26	3	4	1	6	0	15.3.43	23.3.43	9	Follicular	Yes		L.B. ♂ 20.12.43
7	28	4	6	1	0	0	3.5.43	10.5.43	8	Follicular Some subnuclear vacuolation	Yes		L.B. ♀ 22.2.44
8	37	1	3	1	0	0	17.5.43	24.5.43	8	Follicular rather atrophic			L.B. ♀ 28.2.44
9	35	8	0	4	0	0	15.8.43	13.9.43	30	Secretory late	Yes	Yes	L.B. ♀ 17.6.44
10	34	5	0	0	3	3 misc.	3.12.43	3.1.44	32	Secretory late			Misc. 5 months 4.5.44
11	19	1	5	1	0	1 misc.	24.12.43	28.1.44	35	Secretory late			L.B. ♀ 13.9.44
12	28	3	6	1	6	1 S.B.	31.12.43	31.1.44	31	Secretory late			L.B. ♂ 5.10.44
13	34	8	0	4	0	1 L.B.	1.3.44	14.3.44 28.3.44	14 28	Ovulatory Secretory late			L.B. ♀ 6.12.44
14	34	8	0	0	0	1 L.B.	15.3.44	18.4.44	34	Secretory late			Surgical induction at 2½ months
15	25	5	0	2	0	0	14.4.44	18.5.44	34	Secretory late			L.B. ♀ 23.1.45
16	22	2	6	0	3	2 misc.	16.6.44	27.6.44	12	Follicular			Prem S.B. ♀ 10.3.45
17	37	6	8	4	0	1 L.B.	6.9.44	19.9.44	14	Ovulatory	Yes		L.B. ♂ 30.5.45
18	29	3	2	3	0	0	5.9.44	25.9.44	21	Secretory early	Yes		L.B. ♂ 27.6.45

TABLE I (*Continued*)

TABLE I (*Continued*)

Case	Age	Years married Yrs.	Years married Mts.	No contraceptives used before seeking advice Yrs.	No contraceptives used before seeking advice Mts.	Previous pregnancies	Dates of L.M.P.	Dates of Biopsy	Day in cycle	Histology	Tubal insufflation	Treatment before date of biopsy	Result
19	32	4	6	2	0	2 misc.	26.9.44	9.10.44	14	Ovulatory			L.B. ♂ 12.7.45
20	27	2	6	?		4 misc.	28.10.44	7.11.44	11	Ovulatory		Yes	Misc. 5 months 1.3.45
21	34	7	0	0	3	1 L.B. 2 misc.	25.11.44	8.12.44	14	Follicular late or just ovulatory			L.B. ♂ 19.8.45
22	29	5	6	0	4	1 S.B. 2 misc.	29.11.44	21.12.44	23	Secretory early			L.B. ♂ 22.9.45
23	32	5	9	0	4	0	16.1.45	9.2.45	25	Secretory mid			L.B. ♂ 28.10.45
24	41	7	0	2	0	1 L.B. 2 misc.	24.2.45	16.3.45	21	Secretory mid		Yes	L.B. ♂ 15.11.45
25	22	1	0	1	0	0	5.3.45	5.4.45	32	Secretory late	Yes	Yes	Misc. 5 months 5.8.45
26	34	4	10	2	6	0	20.5.45	12.6.45	24	Secretory mid	Yes		L.B. ♀ 27.2.46
27	26	4	10	1	2	1 L.B.	1.11.45	23.11.45	23	Secretory mid		Yes	L.B. ♂ 1.8.46
28	27	1	3	0	6	1 misc.	27.11.45	21.12.45	25	Secretory late			L.B. ♀ 6.9.46
29	21	2	6	2	6	0	13.1.46	8.2.46	27	Secretory late			8½ mts. pregnant now
30	31	8	0	3	0	0	22.4.46	17.5.46	26	Secretory late			5½ ,, ,, ,,
31	32	7	0	1	6	0	28.5.46	20.6.46	24	Secretory mid or late	Yes		4 ,, ,, ,,
32	36	14	0	2	0	1 S.B. 1 L.B.	30.5.46	21.6.46	23	Secretory mid	Yes	Yes	4 ,, ,, ,,
33	33	5	8	1	6	1 L.B.	14.6.46	11.7.46	28	Secretory late	Yes		3 ,, ,, ,,
34	36	12	6	0	10	1 L.B.	16.6.46	12.7.46	27	Secretory late	Yes		3 ,, ,, ,,
35	21	2	6	2	3	0	30.6.46	26.7.46	27	Secretory late		Yes	3 ,, ,, ,,
36	29	5	3	0	6	0	10.8.46	2.9.46	23	Secretory early or mid.			2 ,, ,, ,,

menon of deciduoma-formation following traumatization of the endometrium in animals suggests that it may be something more than chance and that the slight trauma inflicted by obtaining a biopsy may in fact have a mildly therapeutic effect.

SUMMARY.

A short series of cases is described in which material for endometrial biopsy was obtained in the same cycle in which conception occurred without apparently interfering with the pregnancy.

Coarctation of the Aorta in Association with Pregnancy

(A Review of the Literature with Description of a Case)

BY

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ALTHOUGH coarctation of the aorta is such a well-defined and well-recognized congenital lesion, its association with pregnancy is remarkably uncommon. The literature of this country contains few references to the management of such cases, and no comprehensive review. Fawcett,[1] Weber and Price,[2] Gossage,[3] and Evans,[4] each reported 1 case of coarctation of the aorta in women who had borne children, and Maxwell,[5] Bramwell and Longson,[6] Walker,[7] and Billinghurst,[8] have described the course of pregnancy in women with this congenital abnormality, making 8 reported British cases. Several reviews of the subject have appeared in the American literature. Mendelson[9] summarized the reported case histories of 26 women with coarctation who had had children, and added 3 cases of his own. Kinney, Sylvester and Levine[10] reported another case of coarctation in a pregnant woman, and listed in addition 9 new cases from the literature, bringing the total number to 39. This catalogue includes all the reported British cases except that of Billinghurst, which appears to have escaped the reviewers' attention. We have 1 case of our own, and know of 2 cases as yet unpublished, so that with these 3 cases to be described the total stands at 43.

The paucity of cases is at first sight surprising, but coarctation of the aorta is an abnormality which is distinctly more common in males than females. Maud Abbott,[11] in her series of 200 cases in subjects over 3 years of age, found 48 females (147 males, 5 sex unknown). Six of these females became pregnant, and their histories were described by Leudet,[13] Kreigh,[14] Fawcett,[1] Abbott,[12] Katz,[15] and Strassman.[16] The incidence of pregnancy is strikingly low, as most of the 48 patients were women of childbearing age.

MANAGEMENT OF THE INDIVIDUAL CASES.

The occurrence of pregnancy in a patient with coarctation must constitute a certain hazard, but there is a divergence of opinion about the severity of the risk. Opinions must be influenced by the fact that patients with coarctation tend to die young, and to die of their coarctation. In Maud Abbott's series 74 per cent died before or during their 40th year. This being so it is important to try to assess the added risk to life which may be entailed by the occurrence

of pregnancy in such a patient. It appears to depend mainly on two factors which are, firstly, the ability of the heart muscle to withstand the increased circulatory load of pregnancy and labour in addition to the stress of the congenital lesion, and secondly, the integrity or otherwise of the vascular system. Examination of the causes of death in Abbott's series indicates that these two considerations are of roughly equal importance in cases of coarctation in general. Of 200 cases, 155, 77 per cent, died as a direct result of the lesion, analysis showing that the immediate causes of death were:

Rupture of the aorta, 44; cerebral haemorrhage, 24; failing circulation, 60; sudden cardiac asystole, 17; bacterial endocarditis, 10.

Congestive failure was commoner in the older age groups, and vascular accidents in the younger patients, and it is reasonable to suppose that longstanding hypertension, together with minor infections, weakens the myocardium more after middle life than before. Consideration of the physiology of pregnancy serves to remind us that a notable increase in the circulatory burden falls upon the myocardium. According to Hamilton and Thomson[17] the major alteration in the circulation of normal pregnant women consists of an increase in total blood volume up to 45 per cent, starting early in pregnancy, becoming maximal about the 36th week, and decreasing gradually during the last 4 weeks (more rapidly in the puerperium until the non-pregnant level is reached 14 days after delivery). The placental site, acting as an arteriovenous aneurysm, is probably responsible to some extent for the blood volume changes, but the decrease in the blood volume which occurs before separation of the placenta, suggests a hormonal rather than a purely mechanical control. The increased work of the heart is accomplished by increasing the output per beat and the number of beats per minute. Strayhorn,[18] who reported a case of coarctation with observations on the cardiac output during and after pregnancy, concluded that the increase in cardiac output was of the same order as a normal pregnant woman may show, and clinical reports bear out the belief that patients with coarctation support the stress of the increased circulatory burden of pregnancy remarkably well. Few cases have been described as terminating in congestive cardiac failure during pregnancy or shortly after delivery. Fawcett's patient died in congestive cardiac failure 14 days after the birth of her 9th child. She was 45 years old, and suffered from bronchitis. The patients of Maxwell,[5] Laffont and Laffargue,[19] and Lian and Frumuson[20] showed signs of congestive failure early in pregnancy. Maxwell's patient, who failed at the 5th month of her 4th pregnancy, recovered with rest, but the final outcome was not stated. The other patients were treated by therapeutic abortion followed by sterilization. Abbott's patient was a primipara of 34 years, with mitral and aortic stenosis in addition to coarctation. She presented signs of cardiac insufficiency during pregnancy and was delivered by Caesarean section at the 8th month. She "died quietly in her sleep 6 nights later," but the precise cause of death is not stated. Bramwell and Longson[6] described a patient who developed auricular fibrillation, dyspnoea, oedema of the ankles and albuminuria in her 2nd pregnancy and was delivered of premature stillborn twins, but she was also severely anaemic and possibly had toxaemia of pregnancy. They observe that "coarctation of the aorta often seems to impose surprisingly little additional burden on the heart." Sudden death from acute heart failure in pregnancy has not been recorded, but Strassman, and Hamilton and Thom-

son both described one instance of this outcome many years after the patient's last pregnancy The latter authors, with an extensive experience of cardiac patients in pregnancy, and who themselves observed 4 cases of coarctation during pregnancy, gave a good prognosis, but advised that such patients be treated with a régime of restricted exercise, and carefully guarded against unnecessary strains. In only one case, however, was the patient delivered by Caesarean section.

Mendelson, on the other hand, takes a much more gloomy view, going so far as to advise against conception, and holding that induction of abortion with sterilization is indicated if the patient is seen in early pregnancy. He found reports in the literature of 5 patients who died during pregnancy or shortly after delivery, and of 10 patients who suffered exacerbation of their symptoms during pregnancy. Of the former 3 died from rupture of the aorta (these were the patients reported by Strassman, Katz and Leudet), 1 from cerebral haemorrhage at the 9th month (Kreigh) and 1 from cardiac failure (Fawcett's patient, already referred to). Of his own 3 cases 1 was stated to be less well 10 weeks after delivery than she was before pregnancy, and 1 was apparently normal. The The third was undelivered at the time of the report. He intended that she should have a Caesarean section because of the possibility of a vascular accident, the frequency of which he very rightly stressed. Many authors have noted the association of congenital anomalies such as pathological thinning of the aorta and bicuspid aortic valve with coarctation. Harrison[21] described cystic medial degeneration of the ascending aorta with associated dilatation proximal to the coarctation in a man who, however, died not of rupture of the aorta but of cardiac failure. Kinney *et al.* reported a case of coarctation and dissecting aneurysm of the aorta in a 23-year-old woman who was 6½ months pregnant. Postmortem examination showed changes in the aorta similar to the medial degeneration described by Harrison and others. Maud Abbott, as before mentioned, also emphasized the frequency with which cases of coarctation of the aorta terminate in rupture of the aorta or cerebral haemorrhage. Billinghurst described a patient who was free of symptoms during pregnancy until the onset of labour, when she fainted. Recovery was rapid and appeared to be complete, the baby being born without obstetric intervention. Twelve hours later, however, the mother died suddenly, and a postmortem examination revealed rupture of the aorta as the cause of death, with evidence to suggest that the aortic dissection had started some hours before death, presumably when the patient fainted.

Acute failure of the left ventricle during pregnancy or labour might be expected, but in fact appears to be uncommon. Strassman reported a patient with coarctation who had had 7 children, and who died suddenly at the age of 56 years, apparently of acute heart failure. Walker's patient, a primigravida of 31 years, with arm blood-pressure 210/100, left ventricular hypertrophy and poor exercise tolerance, developed acute dyspnoea and distress in the second stage of labour but was successfully delivered by forceps and had an uneventful puerperium. The author concluded that labour should be avoided and Caesarean section performed at term, a view with which many authors concur, particularly Mendelson.

Subacute bacterial endocarditis complicating coarctation might possibly be initiated by sepsis introduced during labour, but a search of the literature does not reveal any obvious relationship except Dustin's[22] patient who died 6 months after delivery. She was a primipara of 17½

years with classical signs of coarctation who complained only of slight dyspnoea during pregnancy. She had a normal delivery. Symptoms attributable to subacute bacterial endocarditis commenced about 2 months afterwards and she died of proven endocarditis. Mendelson's summary of the literature also uncovered 1 case of death from subacute bacterial endocarditis, but symptoms did not begin until 6 months after delivery.

The hypertension which complicates coarctation, being a vascular surcharge of the upper part of the body only, does not appear to carry with it any increased danger of pre-eclampsia, which, if it occurred, would be of very grave import to a patient with coarctation. Hypertensive encephalopathy is described by Hamilton and Thomson in 1 of the 4 patients personally observed by them. Convulsive attacks with loss of consciousness occurred during the 8th month of pregnancy, but the patient was delivered normally. She died suddenly 7 years later, no other pregnancies having occurred, but the cause of death was not determined.

We contemplated these hazards while supervising the pregnancy of another patient.

Mrs. R. S., gravida 1, aged 26 years, was first seen July 30th, 1945, when 3 months pregnant. She gave a history of two attacks of rheumatic fever at 7 and 14 years of age, at which time her heart was thought to have been affected. However, she led a moderately active life and was free of symptoms except headaches. At 19 years of age she had an examination for life assurance and was found to have a high blood-pressure. In 1942, she joined the W.A.A.F. and led a busy but not physically strenuous life till 1944, when she began to complain of increasing fatigue, breathlessness and giddiness on exertion, and fainting attacks. Two years before, the patient had had an attack of breathlessness at night which ended with the coughing of bloodstained, frothy sputum, and for which she was suspected to be tuberculous. During the last 2 years she had also had infrequent attacks of precordial pain brought on by exertion and attributed to indigestion (the patient's exercise tolerance appears to have been extremely variable). In 1944 she was investigated because of her complaints of headache, breathlessness and fainting, and was diagnosed as a case of coarctation of the aorta. She was invalided from the service and advised not to become pregnant.

When examined by us she was found to be well-nourished with a regular pulse, rate 84 per minute. Arm blood-pressure was 208/104 on the right side, 190/108 on the left. The blood-pressure was not obtained in the legs, and pulsation could not be felt in femoral or peripheral leg arteries. There was marked pulsation in the suprasternal notch and visible pulsation in both infrascapular regions. Large pulsating vessels could be felt along the medial scapular borders. The apex beat was diffuse and the heart did not appear to be enlarged clinically. There was a systolic murmur at the base, loudest in the third left intercostal space, and conducted upwards to both sides of the neck, being also well heard between the scapulae on the left, at the level of the fourth rib. No thrill was felt. X-ray of the chest showed moderate cardiac enlargement with hypertrophy of the left ventricle, absence of the normal aortic shadow and notching of the lower borders of the fourth and fifth ribs. The lung fields were clear. An E.C.G. showed left ventricular preponderance. Palpation of the abdomen disclosed an enlarged uterus of the size of 14 weeks' gestation. The liver and spleen were not enlarged, and abdominal aortic pulsations were not felt.

It was at first intended to terminate the pregnancy, but we felt that this was not justifiable without sterilization, which the patient was not prepared to accept. Further enquiry and examination of the literature caused us to modify this view, and as the patient promised to submit to a cardiac régime, it was decided that she should continue the pregnancy and be delivered by Caesarean section at term.

She restricted her activities to a minimum and did no housework, but only had one period of rest in bed, i.e. the 2 weeks under observation in hospital, initially. After this her symptoms of headache, breathlessness and giddiness on exertion, were slightly improved and further bed-rest appeared to be unnecessary until near term, when they again increased a little. The blood-pressure varied, but never rose higher than at the initial examination. After resting in bed it actually fell as low as 130/90 (right arm), the average being 190/100. Albumin was not found in the urine at any time during pregnancy, and from the obstetric point of view everything was normal.

She was readmitted at the 37th week of pregnancy for further rest before delivery. There was no objective sign of decompensation but the blood-pressure remained high. An elective low classical Caesarean section was performed 3 days before the expected date of delivery. Anaesthesia consisted of local injection of 1 per cent procaine using the rectus block method, with additional skin infiltration. Omnopon gr. $\frac{1}{3}$ was given intramuscularly at the beginning of the operation and, as soon as the baby was delivered, morphia gr. $\frac{1}{6}$ was given intravenously. The abdominal wall was more vascular than usual, but the uterine loss was normal. Palpation of the abdominal aorta showed the vessel to be pulsating feebly and of about half normal size. The patient stood the operation well, and the baby, a 9 pounds 6 ounces female, was in excellent condition. The puerperium was uneventful and the patient was discharged 3 weeks after delivery, her cardiovascular system showing no change on examination. Attempts at establishing breast feeding were only partially successful, because the patient was not co-operative in this respect.

Six months later she stated that she was less breathless than before pregnancy. Her arm blood-pressures remained at the same level as before delivery and she still complained of headache. The size of the heart was unchanged clinically and radiologically, but the systolic murmur was now much less pronounced. An E.C.G. showed left ventricular preponderance of the same degree as before. The patient appeared to have been quite unaffected by the pregnancy but was given contraceptive advice. It is proposed to make a reassessment of her cardiac condition in about 2 years time before considering another pregnancy.

We have permission from Dr. Paul Wood and Dr. Horace Evans to quote 2 further cases, as yet unpublished.

(1) Mrs. A. B., 5-para., now aged 37 years, with classical signs of coarctation of the aorta and slight cardiac enlargement, has had 5 normal deliveries and refuses sterilization.

(2) Mrs. S.Z., secundigravida, aged 31 years, was first seen when 3 months pregnant. She had had a normal delivery 18 months previously but had been told to rest during pregnancy because of a raised blood-pressure. On examination her arm blood-pressure was found to be 210/100 and leg pressure 120/100. A widespread systolic murmur was heard over the precordium and pulsations were felt in both scapular regions. Clinically and radiologically the heart appeared moderately enlarged and the aortic knuckle was small. She was rested in hospital for the last 3 months of pregnancy, and had a normal delivery and puerperium.

In spite of these reassuring results and other reported cases indicating the safety of vaginal delivery for patients with this anomaly, we still feel inclined to play for safety in view of the experiences of Walker and Billinghurst, favouring delivery by Caesarean section. It is clear, however, that pregnancy is not contra-indicated in the majority of these patients, though adequate spacing and avoidance of late childbearing seems a wise precaution.

Summary.

The literature on coarctation of the aorta in association with pregnancy is reviewed. One new case is described in detail, and brief notes of 2 other cases not under our care are appended.

We would like to thank Dr. Evan Jones for seeing our case and encouraging us to

allow pregnancy to continue. Our thanks are also due to Dr. Horace Evans and Dr. Paul Wood, who have kindly allowed us to quote their cases, and to the large number of obstetricians and physicians who have been good enough to search their records in an endeavour to find other unreported cases.

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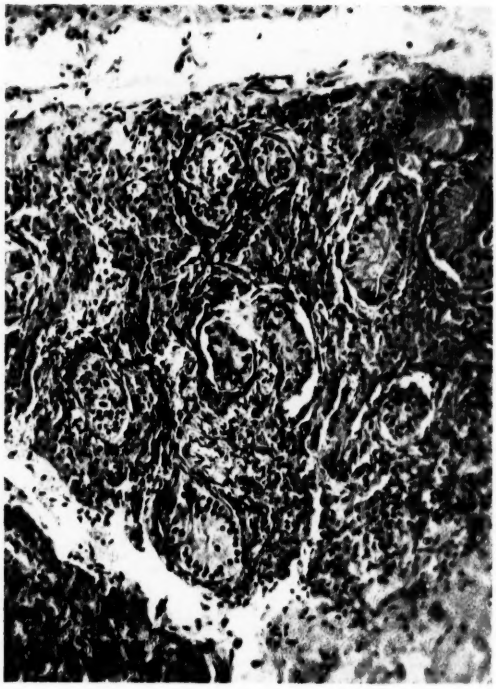

FIG. 1.

Testicle of E.B. (K.161).
Magnification × 150

H. & S.

A Case of Intersexuality—A Clinical and Hormonal Study

BY

A. M. HAIN,* D.Sc., and J. EWART SCHOFIELD, F.R.C.S.

IN the main, intersexuality can be classified into 2 types: the type in which there is a variable degree of malformation of the internal and external reproductive organs due to an embryological fault, and the type in which the secondary sex characters are made to resemble those of the opposite sex under the influence of the excessive hormone secretion of a gonadal tumour or of the adrenal cortex. One is tempted to call the first "genital" and the second "endocrine" but for the fact that instances of the "endocrine" type have been found in newborn infants and the "genital" type may have an endocrine basis.

The patient to be described belongs to the first class and can be more accurately described as a male pseudohermaphrodite, i.e. a person born with male gonads but only partial development of the corresponding external genitalia, and with certain female secondary characters present. The patient was brought up as a girl.

Description of case. When aged 2½ years E.B. had a testicle removed during an operation for right inguinal hernia. When 14 years old "she" consulted J. E. S. for hernia on the other side; the patient was quite unaware of any doubt as to her sex and a full examination could only be made under an anaesthetic.

General appearance. Five feet nine inches in height, generous growth of head hair (red), no axillary or pubic hair, some hair on forearms and on front of legs. General contour of male type: narrow pelvis, absence of female waist, flat breasts, inverted nipples; X-rays showed that the epiphyses were not closed.

External genitalia. At first glance seemed definitely female; labiae present but not well marked. Clitoris size of red end of match; urethra was of female type; poorly developed hymen. Vagina would admit thumb, but ended abruptly and was only 1¼ inches long; no cervix.

Operation for inguinal hernia. Hernial sac was exposed along what looked like the round ligament and opened right up to internal ring in which testicle lay. What was at first thought to be round ligament was the gubernaculum which appeared to find insertion in the region of the pubic spine. By enlarging the opening of the neck of the sac, it was possible to pass a hand into the peritoneal cavity in order to ascertain what secondary sex structures were present. Uterus, Fallopian tubes and ovaries were completely absent. The testicle was removed.

Histologically, the general appearance of the excised testicle was that of a cryptorchid rather than one of adolescence. The few tubules present were lined with a single layer of germinal epithelium; there were large areas in which tubule-formation had disintegrated and in some places degeneration was so far advanced that only a few tubular cells were interspersed with a background of connective tissue; quite a third of the testis was connective tissue. There was also a considerable amount of interstitial tissue, part of which appeared to be secretory (Fig. 1).

Hormonal findings. The patient's daily hormone output prior to operation was: 17-ketosteroids: 11.9 and 6.7 mg.; pregnanediol: none; combined oestrogen: <2 I.U.; gonadotrophin >106 M.U. The methods of hormone estimation used were: ketosteroids—Patterson's (described by Hain 1947); pregnanediol—Venning (1938); combined oestrogen—Callow *et al.* (1939); gonadotrophin—modification of Scott's (described by Hain, 1947).

As the average adult male and female excrete respectively 13.3 and 7.4 mg.

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17-ketosteroids daily, the androgen excretion of our patient, taken in conjunction with an absence of pregnanediol excretion, ruled out the possibility of hyperplasia or tumour of the adrenal cortex being the underlying cause of the intersexual condition. Owing to the overlapping of hormone values for the 2 sexes it is not possible to determine sex by reference to the excretion of androgen and oestrogen. The absence of any detectable oestrogen excretion is not surprising as the patient had no more than a single rudimentary gonad.

The most interesting feature hormonally is the very high gonadotrophin output: >106 mouse-uterine units (M.U.). In a series of women and men Werner (1941; 1943) demonstrated that apart from peaks of excretion around ovulation in the former, and spurts of varying duration in the latter, the average gonadotrophin output for both sexes was between 5 and 20 M.U. per 24 hours. In women values might rise to 40–80 M.U. around ovulation; in men they rarely exceeded 40 M.U. Evans and Gorbman (1942) detected 6–20 M.U. gonadotrophin per litre in men. The explanation of the excessive secretion of gonadotrophin (follicle-stimulating hormone) lies in the fact that our patient was a cryptorchid. Martins (1930) noticed that, in animals, cryptorchidism led to histological changes in the anterior pituitary which, though less pronounced, resembled those following castration, including the presence of "castration cells". This experiment and those of Nelson (1934a; 1934b) suggested that castration, and to a minor degree cryptorchidism, so affected the pituitary that it produced a continuous and enhanced supply of follicle-stimulating hormone and little or no luteinizing hormone; parabiotic union of a normal female with a cryptorchid male caused the female to be in constant oestrus accompanied by excessive follicular development of the ovaries without luteinization. The striking observation in our case is that a person aged only 14 years should have been excreting gonadotrophin in amounts typical for the adult castrate. The implication is that the pituitary is susceptible to gonadal influence for a considerable time before puberty is reached. It is commonly held that the anterior pituitary does not become active until puberty and, in the absence of a satisfactory method of recovering urinary gonadotrophin, none had been detected in the urine of children. Supporting this premise, Henderson and Rowlands (1938) found that the gonadotrophic potency of the human pituitary is slight during early childhood. In order to throw light on this point, the gonadotrophin excretion was ascertained (by A.M.H.) in a number of children of both sexes from 5 to 14 years of age. As in the adult, so also in children, there are considerable fluctuations in hormone output in the same individual. In 9 girls between the ages of 5 and 9 years the gonadotrophin output varied from <2 to 10 M.U. daily, and in 8 boys aged 8–12 years the range was <2–18 M.U. daily; a boy aged 14 excreted 14 and 28 M.U. Since it is thus obvious that the anterior pituitary secretes gonadotrophin from an early age, it is not surprising that cryptorchidism in a child should have the same effect on pituitary function as that produced in an adult.

A somewhat similar case was described by one of us (Hain, 1947) in which the child was only 8 years old. There was no other symptom of virilism than an hypertrophied clitoris; the ketosteroids were less than 2 mg. per 24 hours but the daily gonadotrophin output was 20 M.U. Quite rightly operation has been postponed until the patient is a little older as the surgical procedure in such cases is generally determined by the psychological outlook of the patient, whether dominantly male or

female. It is probable that Dr. T. N. MacGregor's patient (Hain, 1947) is another male pseudohermaphrodite but unfortunately permission to operate was not granted. In this case the patient was brought up as a girl until 17 years old, when, in addition to a penis and vagina, a testicle in each inguinal canal was found. As only a small sample of urine was received for analysis, it was not possible to estimate more than the 17-ketosteroids output, which was 15.6 mg. per litre of urine—a figure which does not denote any appreciable hyperfunction of the adrenal cortex.

One naturally tends to think that the urinary androgens are excreted by the testes but only a small proportion is derived from this source. This is shown by the fact that women excrete almost as much 17-ketosteroids as men, and that eunuchs excrete very little less than normal males. Their chief source is the adrenal cortex and in hyperplasia or tumour of the cortex the androgen excretion may run into hundreds of milligrammes per 24 hours.

This raises another interesting point. In cases of doubtful sex it is possible, with a knowledge of the 17-ketosteroids output, to differentiate between virilism in a female due to adrenal cortical hyperfunction (female pseudohermaphroditism) and faulty development in a male due to a lack of suppression of primitive female structures (male pseudohermaphroditism). In the female with pseudohermaphroditism the excretion of 17-ketosteroids is greatly in excess of the normal range and may even exceed 100 mg. per 24 hours: generally, though not invariably, pregnanediol also is excreted. Young (1937) cites 17 examples of the condition taken from the literature, to which he adds 4 of his own, in all of which the abnormality was associated with greatly enlarged adrenals. Typical cases have recently been described by one of us (Hain, 1947). On the other hand, the male pseudohermaphrodite excretes normal amounts of androgen or values only slightly above normal, and Neugebauer (1908) found that in only 0.7 per cent of cases was there bilateral hyperplasia of the adrenal.

The defect in the male pseudohermaphrodite is attributed by Young to malfunction of the interstitial cells of the testis in the embryo. In his opinion a certain quality of the gonad is required to bring about full development of the external genitalia and, in male pseudohermaphrodites, the necessary stimulus was not at hand at this stage of embryological development and consequently the penis, prostate and seminal vesicles did not form. Young's suggestion implies that the gonad secretes before birth, which is very doubtful; indeed all the evidence admirably reviewed by Moore (1944) is strongly against such an idea. Broster and Vines (1933) attribute the abnormality to malfunction of the adrenal cortex at a critical stage of embryonic development. In the foetal adrenal, according to these authors, the cortex has a strong masculinizing influence from the 10th to the 18th week in the male, whereas a weaker influence is exerted in the female and only from the 11th to the 14th week. The " masculinizing influence " in our case was established early enough to suppress the ovaries and uterus but not the rudimentary vagina; it is feasible to suppose that the androgenic function of the adrenal cortex was too weak, however, to bring about full development of the male secondary characters. At the same time it is curious that there is almost complete suppression of the female secondary sex apparatus in association with such slight development of that of the male both internally and externally. In the 8 male pseudohermaphrodites described by Young the extent to which the development of the external genitalia was arrested and Mullerian structures were present was, on the

whole, in inverse ratio to the development of male structures. Departure from this general rule might be due to differences in tissue response or in the initial stimulus and the time of its impact, or again in some cases the explanation may lie in a disturbance of the chromosome formula. Evidence in favour of a hereditary basis for the condition has been put forward by Kallmann *et al.* (1944). In the opinion of Novak (1935) such patients are genetic females in whom the sex reversal took place at an early phase of development. On the other hand, statistical evidence strongly suggests that these were genetic males; the sex distribution in such families taken from the records of Bonnier and Moebius and quoted by Witschi (Allen, 1939) is as follows:

Sex distribution in families with hereditary male pseudohermaphroditism (m.p-h)

Sex of children.		
♀	♂	m.p-h.
58	13	42
	55	

Witschi adds thereto 2 families exhibiting a hereditary type of hypospadias which is supposed to represent the lowest grade of pseudohermaphroditism and in which the sex distribution showed a similar tendency. In our case the only other member of the family was a brother.

In such cases the problem that faces the surgeon is one of procedure. Should the testis be left or removed? As a rule the patient is psychologically female and either this fact or the wishes of the parents determine for the surgeon what course to adopt. All the patients referred to below, including our own case, were female in disposition and the question was rather one of possible risk in retaining the gonad. Broster and Vines (1933) performed bilateral orchidectomy in their 2 cases (Nos. 17 and 18); Novak (1935) also removed the testicle in order to be certain that male characteristics did not develop. Young (1937) on the other hand, replaced the testicle in the abdominal cavity in the belief that it might be the source of the oestrogen responsible for the feminine disposition of the patient. By retaining the testis there would, in our opinion, not only be the risk of its becoming secretory and giving rise to embarrassing symptoms of virilism, but also it might become the seat of a teratoma at a later date. In the case of E.B. very little oestrogen was recovered by urinary analysis and it is unlikely on this and on histological grounds that the gland removed was secreting effective amounts of this hormone. There was no doubt about the feminine disposition of our patient. She was observed while in hospital to be "very keen on her personal appearance, often combing her hair and busy with her face toilet . . . not at all unattractive . . . blushes easily."

Summary.

A male pseudohermaphrodite, aged 14, is described.

It was possible by estimation of the excretion of 17-ketosteroids (urinary androgens) to distinguish between male and female pseudohermaphroditism and so to exclude adrenal cortical hyperfunction.

An excessive excretion of gonadotrophin (F.S.H.), typical of cryptorchidism, was an outstanding feature and demonstrated that the pituitary secretes, and is itself under gonadal influence, before puberty.

The probable origin of the developmental defect is discussed.

The question of the procedure to be adopted by the surgeon in such cases is debated.

Acknowledgment.

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Kirk Duncanson Fellowship from the Royal College of Physicians, Edinburgh, for which the author expresses indebtedness.

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CRITICAL REVIEW

A Survey of Gynaecological Surgery

BY

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THE progress of gynaecological surgery for the last 40 years has been marked more by the modification of old operations than by the introduction of new ones. This is not to be wondered at seeing that our art was handed on to us by surgeons at least as ingenious and persistent as ourselves: "There were great men before Agammenon."

Of the really new operations I would place first McIndoe's grafting operation for the construction of a vagina. Its results are remarkable, the canal thus fashioned being, after a very short time, indistinguishable from the normal vagina. Best of all it carries practically no risk with it, and of the 46 operations which McIndoe has now performed in conjunction with various gynaecological surgeons every patient has recovered, and there was only one in which the desired end result was not accomplished. I have no doubt at all that it should replace all other methods of constructing a vagina. Of these Baldwin's operation is the best known but the transplantation of a segment of ileum entails a very definite risk to life. Such disasters do not get into the medical press, but I know of two, both women dying of intestinal obstruction at the site of the anastimosis. Such a happening is doubtless preventable but obviously there are other risks besides this one. I have performed the operation 7 times and am heartily glad that I shall never need to perform it again; for it is a most responsible procedure and one which puts a great strain on the surgeon. Moreover its risk limits its application to those cases where abolition of the deformity is urgently called for, whereas McIndoe's operation is so safe that it can be advised in any case, irrespective of whether the girl has marriage in prospect or not. What I have said about Baldwin's operation applies equally to the transplantation of a segment of the large bowel. Skin grafting operations to remedy the deformity in which the graft is whole-thickness skin are clumsy and tedious in performance, whereas McIndoe's operation can be carried out very quickly. It will, I think, always involve the co-operation of a plastic surgeon with a gynaecological surgeon since the latter has no opportunity of becoming expert in the cutting of a large superficial graft.

The second new operation I would mention is the suspension of the urethra by strips of abdominal fascia to rectify stress incontinence. This operation, which originally derived from the continent, has been well put to the proof by Chassar Moir (1945) in England and Aldridge (1944) in the United States, but in my opinion the best technique is that recently introduced by Terence Millin whereby the suspension is effected entirely through the abdomen, instead of the two-way approach previously employed. Excellent immediate results have been obtained

by all the surgeons named, but we must bear in mind that sufficient time has not yet elapsed to estimate the long-term results, for the tissues may stretch again. Even if such is proved not to occur I think that in the majority of cases of stress incontinence, the far lesser vaginal operation, which I originally devised 30 years ago, should be given a trial before resorting to the newer procedure which is of much greater magnitude.

It should be noted that neither of the two surgeons who have thus contributed to gynaecological surgery are themselves gynaecologists, and indeed all the great advances in this field stand to the credit of men who had other surgical interests besides gynaecology. Narrow specialism, though it achieves excellence in established procedures, seems to be unproductive of major progress.

The total hysterectomists continue to be vocal with, I think, harmful results, for while in expert hands the risk of removing the whole uterus is very little greater than removing the corpus only, in the hands of surgeons who only occasionally invade the pelvis is quite otherwise. I mind me of an unfortunate nullipara of 30, who, having a single fibroid, had her uterus and the base of her bladder removed together! All gynaecological surgeons of experience have come across such cases and genito-urinary surgeons are quite familiar with them. The threat of carcinoma in the retained cervix has always left me cold. In my series of 500 Wertheim operations there were 7 stump carcinomas and in 3 of them the growth was undoubtedly present when the subtotal hysterectomy was performed. It must be remembered, too, that cases of carcinoma of the cervix, as a class, have a much more stormy obstetrical and gynaecological history than the average woman, and amongst them the proportion of individuals who have undergone a previous operation is above the general average. The difference of opinion chiefly concerns hysterectomy for fibroids. Now a large proportion of these patients have never borne children and thereby have escaped the common determining cause of carcinoma of the cervix. An obviously unhealthy cervix, especially if split, should of course be removed with the corpus but for the rest the least operation which effects a cure should be chosen.

Wertheim's operation continues to be carried out by a number of gynaecological surgeons despite the confident prophecies of the all-out advocates of irradiation, and it is interesting to note that in the United States, where for years the operation had been very little practised, there is a swing in favour of surgical measures. This is as it should be, for some cases of carcinoma of the cervix are better treated by surgery than by irradiation, and it would be an irreparable loss to gynaecology if the skill necessary to do the operation was permitted to die out.

Myomectomy has an increasing vogue amongst the elect but hysterectomy is still constantly being performed by the less skilled in cases where the conservative operation would be just as feasible and safe, or even safer. This is a matter for education in which the leaders of our calling must be the exemplars and teachers. The scope of the operation has been enormously enlarged, chiefly because means have been found to obstruct the blood flow to the uterus during the operation, and it can be claimed that, as far as the technical difficulties dependent on the number, size and position of the fibroids are concerned, the operation can be carried out on at least 95 per cent of the cases. This is a great advance, for the surgeon now has a free hand to decide whether conservative or radical measures best accord with the patients' interests, instead of being pressed

or driven to hysterectomy by fear of the difficulties and risks attaching to myomectomy.

Conservative surgery has been further enlarged by the operation of ovarian cystectomy, whereby ovarian cysts are shelled out and the whole of the ovarian substance conserved. The operation is applicable to all obviously innocent cysts and is specially beneficent to those cases where, in a young woman, both ovaries present multiple cysts—follicular, chocolate, or dermoid. Stanley Way (1946) has pointed out that in the case of ovarian cysts, recently and not severely twisted, if the surgeon, having untwisted the pedicle, will wait a little while, circulation re-establishes itself and ovarian cystectomy can safely be carried out instead of ovariotomy.

The operation appears to be a singularly safe one, there being no deaths in a series of over 300 operations recently reported. The importance of conserving all sound ovarian tissue is being increasingly recognized but the needless removal of ovaries is by no means extinct as yet.

Turning to the surgery of the Fallopian tubes, the reduction in the incidence of gonorrhoea and still more the improved methods of treating it, have greatly reduced the number of these cases, so common 40 years ago, where a double pyosalpinx with ovarian abscesses, and extensive adhesions made the necessary operation a very severe and difficult one. In my younger days two or three of such cases could be found in any gynaecological ward on any day of the year.

The conservative surgery of the Fallopian tubes (salpingostomy, tubal re-implantation) logically followed the introduction of tubal insufflation, and various operators have published their results. These are frankly disappointing, only 15 to 18 per cent of the patients wishing to have a child having become pregnant afterwards; and some surgeons have become disheartened and hesitate to advise an attempt to reopen closed Fallopian tubes. I deprecate this defeatist attitude. That success can be obtained is clear, and if, as I believe, imperfect technique is the cause of its rarity, our course surely is to improve upon it and not abandon the operation altogether. It has been stated that operatively reopened Fallopian tubes almost invariably become closed again within a year, but I know of many cases which contradict this pessimistic view.

For retroversion, shortening of the round ligaments by one or other of the many methods holds the field and the older ventral fixation is not often performed nowadays. The disrepute into which it has fallen derives from a distinguished gynaecological surgeon, who took to fixing the posterior wall of the uterus and when disasters in pregnancy began to accumulate denounced the whole operation, however performed! His voice was so authoritative that textbook after textbook down to the present day has repeated the condemnation. As a fact, fixation of the anterior wall has absolutely no effect on pregnancy or labour, and there are times when it should be chosen instead of round ligament shortening.

Long experience has taught me that there is one definite disadvantage to ventral-fixation, it is this: the posterior pelvis is abnormally opened up, with the result that a larger proportion of intestine occupies it. This increases the intra-abdominal pressure in Douglas's pouch, and if the posterior vaginal vault is already weak a prolapse in that situation (hernia of Douglas's pouch) is liable to develop. I have knowledge of 4 such cases in the last 10 years.

The reparative operations for prolapse have become pretty well standardized and

are so successful that pessaries are now only rarely advised. The vogue for removing the uterus as part of the operation is fashionable on the other side of the Atlantic and has some followers in this country: I hold it an entirely unnecessary thing to do (unless, of course, the uterus needs removing for a cause additional to the prolapse) and a relic of the old false view embodied in the lay expression "falling of the womb." Prolapse is the result of the vagina partially or completely turning inside out, and as such it is a purely vaginal phenomenon. The uterus by its bulk obstructs the movement, which is why complete prolapse is scarcely ever seen except in women past the change of life. or in those on whom total hysterectomy has been performed. The most difficult cases of complete prolapse to cure by operation are those where the patient has previously had her entire uterus removed. What I have said does not imply that the operations which include hysterectomy fail to cure the prolapse: they do; but the same result can be achieved without this needless enlargement of the operation.

As regards those disappointing cases where, after a reparative operation has been performed, the patient some years later returns again complaining that "something falls"; I would point out that in a number of these instances the return to the surgeon is occasioned, not by the work he did having given way, but by the development of a prolapse in a new situation. Thus after posterior colporrhaphy a posterior vault prolapse or a cystocele may appear, or, after anterior colporrhaphy, prolapse of the anterior vaginal vault.

The marked improvement in the results of gynaecological surgery which has been brought about in the last 40 years is due not only to advances in the technical details of the operations and the introduction of new procedures, but equally to the great increase in the adjuncts to surgery which the surgeon of today now enjoys. Chief amongst these is the perfection to which blood-transfusion has attained. In my younger days the most severe operations (Wertheim's for instance) had to be performed without this powerful aid. Saline infusion was employed, but only when the patient was *in extremis*. In connexion with infusion I would call attention to the excellent work of Avory and Naunton Morgan who showed that ordinary saline solution puts a great deal too much salt into the patient.

Spinal and intravenous anaesthesia have contributed to the improvement in no small degree, while better theatre technique and more efficient methods of antisepsis have played a great part too. From 90 per cent of women *S. Aureus*, often haemolytic, can be recovered from the abdominal skin; a fact which should give all abdominal surgeons cause to think furiously.

The attention now being given to the prevention of air infection has great historical interest, for it revives the original Listerian teaching. Lister endeavoured to counter it by the carbolic spray and failed, whereupon a school of thought arose which maintained that the danger was non-existent; a perfect example of Huxley's dictum: that many a truth has been turned down because of the faulty argument with which it was propounded. The splendid work of Leonard Colebrook (1944, 1946) should be studied by all surgeons. He makes it perfectly clear that patients should come into the theatre covered only by a paraffined blanket, the clothing having been taken off outside; and that in the future every operating theatre should be air-conditioned and fitted with an air-filtering device.

The steady advance of our art, which I have tried to outline in this cursory review,

shows at least that there is no finality in surgery. In climbing the tree of knowledge we stand upon our predecessors' shoulders and pluck fruit which they could not reach and our successors will stand on our shoulders and reach further still. The thought is humbling, but salutory, for it forbids any of us to cease climbing when so much is ahead.

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BOOK REVIEWS

"Food and Nutrition." By E. W. H. CRUICKSHANK, M.D. (Aberd.), D.Sc. (Lond.), Ph.D. (Cantab.), M.R.C.P. Regius Professor of Physiology in the University of Aberdeen. Edinburgh: E. & S. Livingstone Ltd., 16 & 17 Teviot Place. 1946. Price 16s. net.

THE author modestly describes his work as "a brief survey of the present knowledge of the Physiology of Food and Nutrition, and of the means whereby this country met the problems of feeding the nation during the six years of war." The survey is comprehensive and explores every aspect of the subject of nutrition from the prehistoric past up to the Food and Agricultural World Organization of to-morrow.

The book admirably fulfils its purpose as a guide for the use of medical students and practitioners, and for all who are concerned with the part food plays in promoting the welfare of the individual and of nations.

Professor Cruickshank is convinced that malnutrition normally exists throughout the world. In this country in 1938 roughly 30 per cent of the population were undernourished or wrongly nourished. In India, from Dr. Aykroyd's survey, a large proportion of the 400,000,000 inhabitants have a diet which never approaches the physiological requirements; the relationship between diet and the incidence of disease is plainly manifest in India.

It is many years since Sir John Boyd Orr, by statistical investigations in the United Kingdom, demonstrated that the food value of the family diet is, in general, dependent on the income. In the higher wage groups more was spent on milk, meat and protective foods. To distribute food to the best advantage the Ministry of Food gave priority to children, and mothers and invalids. Milk and meals are provided in schools and vitamin supplements made available free or at a low cost. Unfortunately these privileges are often not used by the mothers; the Scottish mothers, in this respect, have proved no more canny than the British housewives.

The physiological section of the book begins as is usual with an account of the energy requirements for each sex and as modified by age and activity. An outstanding feature is the graphic description of apparatus for estimating the basal metabolic rate and of the apparatus for estimating the energy value of foodstuffs. Famine in so many parts of the world has demonstrated with painful clarity that a supply of energy is the primary nutritional need. Later chapters give a clear account of requirements for protein, mineral salts and vitamins.

The application of this knowledge on a world scale is to be the task of the Food and Agricultural Organization. The agriculture of all nations is to be contrived on an interlocking design to avoid excesses and shortages in the supply of essential foods. Foodstuffs produced in physiologically planned proportions are, if anything ever goes according to plan, to be distributed equitably between the nations. It is easier to grow an

ample supply of cereals than it is of fats, protein, minerals and vitamins.

Education of the people is needed to induce them to eat a more wholesome diet. The rationing during the war has produced a better average level of nutrition followed by an improvement in the health of the nation. This gain will be lost if on release from constraint there is a reversion to white bread and sugar as staple energy foods. The wartime flour of 85 per cent extraction is approved by food scientists and, as Professor Cruickshank asserts, there is no reason to believe that the phytic acid in cereals exerts any rachitogenic effect in good diets. Correlated with this point it is wise, he says, to note that administration of excess of calcium, without a supply of vitamin D is likely to do more harm than good. It is important that each locality should review its iodine situation.

The value of the book is reinforced by the inclusion of numerical tables, statistical figures, diagrams and graphic illustrations of human beings and animals who have eaten neither wisely nor well. The index apparently has suffered from paper rationing and is austerely brief.

"Child and Adolescent Life in Health and Disease: A Study in Social Paediatrics." By W. S. CRAIG, B.Sc. (Glas.), M.D. (Edin.), F.R.C.P.E., F.R.S.E. Formerly First Assistant in the Department of Child Life and Health, University of Edinburgh, etc. With a Foreword by Professor CHARLES MCNEIL, M.A., M.D., F.R.C.P., F.R.C.P.E., F.R.S.E. 1946. Price 25s. Edinburgh: E. and S. Livingstone.

The close liaison that is becoming increasingly established between obstetrics and paediatrics, and the present planning of both future services, will assure this book a warm welcome. Professor Craig has provided the historical background that is essential to the understanding of their past development in so far as child health is concerned, and gives an excellent review of the child health services as they are designed to-day. A useful section is devoted to legislation relating to child and adolescent welfare, and appendices list representative hospitals, special schools, societies, etc., concerned with children. The author is obviously aware that the "jigsaw" of child care is unfinished, but even so the difference between the Curtis Report on the care of children and the impression gained from Professor Craig's book is illuminating. The former makes clear that many of the admirable legislative and other provisions for children are liable to break down in practice, and lead to such tragedies as were revealed by the recent O'Neill case, whilst Professor Craig is perhaps rather more concerned with the progress that has been made since the Nineteenth Century and inclined to take a rosier view of the services as they exist to-day. He is also unusually tolerant of the legislative slow motion that until recently has ensured that reforms were only initiated when the case for them was abundantly proven. At a time when it is fashionable to belittle the achievements of the social services, it is salutory to have this illustration of how much has, in fact, been done for child health, both before 1939 and during the war years, and to see present conditions in perspective with those existing in the Eighteenth and Nineteenth Centuries. As a book of reference this will be found invaluable. It is copiously, if a little uncritically illustrated, and is admirably produced.

ROYAL COLLEGE OF OBSTETRICIANS AND GYNAECOLOGISTS

Examination for the D.Obst. R.C.O.G., October, 1946

The following Candidates have been successful in the Examination for the Diploma in Obstetrics:

Tariq Munir Abbas.
John Schonberg Astbury.
Robert Henry Obuabasa Bannerman.
Alan Barker.
Arnold Priestley Bates.
Trevor Cory Beard.
Alan Victor Greenwood Bibby.
John Montgomery Bowen.
Samuel Burke.
Denis John Burnett.
Diana Butler.
Peter Haig Cardew.
Thomas Ernest Ashdown Carr.
Betty Josephine Clymo.
Christopher Kersley Cole.
Norman Keith Crooke.
Thomas Kenneth Davies.
Ruth Millicent Dearing.
Janet Margaret Done.
Kathleen Agnes Dru Drury.
Richard Christopher Dwyer.
Charles Thomas Fawsit Ealand.
William Stewart Rolleston Fenton.
Hugh Flack.
Mary Francis.
William Kingswell Frewen.
Kamel Girgis.
Mary Elizabeth Goodson.
Alfred Henry Grenz.
Geoffrey Edward Roper Hamilton.
Emily Gertrude Hamlyn.
John Robinson Hassan.
Lore Marguerite Hasslacher-Traub.
Joseph John Hayward.
Mary Angell Hewett.
Monica Margaret Hogben.
Frank Lionel Edward Hugh-Musgrove.
Eric Douglas Hull.
George Arnold Humphreys.
James Barclay Joyce.
Christine Kirby.
Thomas Henry Lawton.
Constance Gertrude Lee.
Joan Mary Levett.
Kathleen Vernell Lodge.
Ernst Lucas Loewenthal.
Alison Jean McNairn.
Kathleen Margaret Agnete Millard.
Vishwanath Vaman Mohile.
John Anthony O'Neill Mulcahy.
Nestor John Stanley Nathan.
Arthur Denness Newsholme.
Rosalind Mary Louisa Nicol.
John Michael Norman.
Richard Tonkin Norman.
Rachel Jacob.
William Bernard O'Brien.
James Joseph O'Donoghue.
John Joseph Francis O'Sullivan.
William Henry Phillipps.
Geoffrey Turner Pitts.
George Ernest Prendiville.
Robert Williamson Kinross Purser.
Jean Finlay Ramsay.
Mary Jean Reading.
John Stuart Redfern.
Theodore Francis Redman.
Brian Charles Middleton Reed.
Edward Ridehalgh.
Frank Leonard Robertshaw.
Thomas Wilson Roddie.
John Vincent Rose.
Helen Margaret Russell.
Henry Ernest Rutherford.
Llewellyn Charles Rutter.
John Archibald Sadler.
John Cyril Tabor Sanctuary.
Eleanor Margaret Sawdon.
Kenneth Bryan Scott.
Harold Needham Skelton.
Margaret Eleanor Anne Slater.
Sydney Alexander Swanson.
John Mervyn Thomas.
Richard Radford Trussell.
Charles Michael Ferrier Walters.
Philip de Silva Wijesekera.
Donald Mervyn Wilkins.
John Wills.
Benjamin Walter Wood.
Maurice Roy Woods.

REVIEW OF CURRENT LITERATURE

This review is made in collaboration with the Abstracts Service of the *British Medical Journal*.

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ANATOMY

1. **Superiority of the South African Negro or Bantu as a Parturient.**
By O. S. HEYNS. *J. Obstet. Gynaec.*, **53**, 405–429, October 1946.

2. **Outlet Pelvimetry. A Commentary, and the Presentation of a Pelvimeter for Measuring the "Symphysis and Sacral Biparietal Distance".**
By H. THOMS. *Surg., Gynec. Obstet.*, **83**, 399–402, September 1946. 9 figs., 4 refs.

3. **The Muscle of Micturition. Its Role in the Sphincter Mechanism with Reference to Incontinence in the Female.**
By W. T. KENNEDY. *Amer. J. Obstet. Gynec.*, **52**, 206–217, August 1946. 12 figs.

If progress is to be made in the treatment of diseases of the female urethra, further study of its anatomy and physiology is required. The sphincter and muscles of the urethra, both smooth and striated, are variously described by different authors, so that it is certain that the anatomy of the part is not clear. To gain information on this subject a study of serial sections of the urethra has been made in two planes at right angles, which has given information regarding its musculature. Several photomicrographs are shown. As a result of these studies it is found that the levator ani muscle is inserted in the lateral part of the urethra at the junction of the middle and upper thirds. The true sphincter is composed of the circular smooth muscle surrounding the middle and upper thirds of the urethra, together with longitudinal smooth muscle; it may be regarded as a cylindrical sphincter. The intrinsic voluntary muscle fibres make up a single muscle of unusual shape and function which has been named the muscle of micturition. This muscle has two origins and two insertions and its own nerve supply from the pudendal trunk, and is independent of the other muscles in the neighbourhood. The origin is by two slips of muscle attached to the periosteum of the anterior medial face of the ramus of the pubis, and the muscle passes in the form of a purse string between the circular and longitudinal muscles of the sphincter to end in two slips which fuse with the longitudinal muscle in the bladder neck. This muscle is quite separate from the levator ani, the bulbocavernosus, ischiocavernosus, and the transverse perineal muscles. When the muscle of micturition relaxes, the true or cylindrical sphincter exhibits its maximum control and no urine runs out of the bladder. When it contracts completely the cylindrical sphincter is distorted into an oval formation throughout its length. In this voiding state all urine can escape from the bladder. If complete contraction becomes permanent, complete incontinence exists. Any partial contraction will carry with it a corresponding degree of incontinence.

L. W. Lauste

PHYSIOLOGY

4. **Studies Concerning the Cause and Purpose of Menstruation.**
By O. W. SMITH and G. VAN S. SMITH. *J. clin. Endocrinol.*, **6**, 483–492, July 1946. 1 fig., 30 refs.

5. **Basal Temperatures in the Normal and Pathological Menstrual Cycle.** (La temperatura de base en el ciclo menstrual normal y patológico.)
By A. FOIX. *Rev. méd.-quir. Pat. fem.*, **25**, 133–157, May 1946. 14 figs., 32 refs.

Basal body temperature is ascertained by rectal temperatures taken each morning before rising. Precautions needed to obtain accurate readings include using the same thermometer for the same number of minutes at the same hour each day. Rectal temperatures are the most reliable, though some authors take temperatures by mouth. No food or drink must be taken before recording. Any slight febrile illness alters the curve and a characteristic curve is found in cases of pelvic infection.

In the normal menstrual cycle the basal temperature curve is bi-phasic—a phase of low temperature followed by one of slightly higher temperature. The change in the curve from lower phase to higher takes place in the normally menstruating woman 14 days before the onset of the next expected period, and this indicates that ovulation precedes the next menstruation by 14 days, no matter what the length of the cycle. It has been shown that oestrogenic hormones and testosterone cause a fall in temperature, while progesterone causes a rise. Other workers have shown that glycogen appears in the endometrium, indicating a corpus luteum phase, with typical changes in the endometrium, following the rise in basal temperature. They conclude that the normal change in temperature indicates ovulation. In metropathia the low basal level is maintained throughout the cycle.

Basal body temperatures may be used in various

ways: to study ovarian function, to determine the time of maximum and of minimum fertility, as a test of pregnancy, to determine the effect of treatment designed to promote ovulation, to guide biopsies done for evidence of the secretory phase, to investigate types of metropathia haemorrhagica, to study the aetiology and pathology of amenorrhoea, and to study the intermenstrual crisis and dysmenorrhoea. The author presents several graphs of basal body temperature in cases of pelvic infection, and shows that in such cases a higher curve is superimposed on the curve of the normal menstrual cycle, the height of the curve depending on the severity of the infection.

[This paper contains little that is original and is mainly a review of work by earlier authors. The chief interest lies in the observations on curves in cases of pelvic infection.]

Josephine Barnes

6. **Colorimetric and Biological Determination of Folliculin during the Menstrual Cycle and Pregnancy.** (Détermination colorimétrique et biologique de la folliculine au cours du cycle menstruel et de la grossesse.)

By M. F. JAYLE, O. CREPY, S. VANDEL, and O. JUDAS. *Bull. Soc. Chim. biol.*, **28**, 363–371, April–June 1946. 4 figs., 3 refs.

Determinations were made of folliculin (oestrone) by both chemical and biological methods during the menstrual cycle and during pregnancy. The chemical method had been described previously, and depended upon preliminary ethereal extraction of the phenolic fractions (from human urine), and subsequent purification and determination photocolorimetrically. The chromogenic value was expressed in terms of oestrone, except where a strong phenolic fraction was separated and expressed as oestriol. By this method oestriol and α-oestradiol gave colour values respectively 1.7 and 2.2 times weaker than with oestrone. The biological assay was determined in ovariectomized rats and mice by examination of the vaginal smears according to the test described by Allen and Doisy. In this test α-oestradiol is 3 to 5 times more active than oestrone.

It was found that during the course of 7 normal menstrual cycles the colorimetric method gave values which were about 20 times greater than those obtained by the biological method. The initial level by the latter method was about 25 international units per day (0.1μg. oestrone = 1.0 I.U.) rising to 160 I.U. at 21 days, then falling to the initial level by the beginning of the second cycle. The curve obtained by the colorimetric method showed 3 peaks, the most important of which was considered to be in the middle of the cycle at the time of maximum development of the corpus luteum. The results were interpreted on the assumption that the chemical method estimated the total chromogenic value of the phenolic steroid compounds, irrespective of their oestrogenic activity. The curve was thought to follow the physiological activity of the ovarian cycle, though at a different level from that found with regard to the biological assay of the oestrogenic activity in the urine.

The oestrogenic activity of the urine does not increase immediately following pregnancy; an increase in folliculin does not occur until about the second month when (in the biological test) there is a rise from 400 I.U. to 2,400 I.U. at 75 days. Only 2 pregnancies were observed (both in the same woman), 1 of which ended in a miscarriage at the fiftieth day, the other going to full term. At the beginning of the third month the chromogenic value of the urine (chemical test) increases from 600 to 1,300 μg. at 270 days. By separation of different phenolic fractions it was deduced that the increase of α-oestradiol during labour and at the termination of the pregnancy accounts for only a part of the oestrogenic changes which take place in the urine. It was thought that during the ninth month another unidentified oestrogen may be present.

R. Wien

7. **Colorimetric Estimation of Pregnandiol glycuronide during the Menstrual Cycle and Pregnancy.** (Dosage colorimétrique du prégnandiol glycuronide au cours du cycle menstruel et de la grossesse.)

By M. F. JAYLE and O. LIBERT. *Bull. Soc. Chim. biol.*, **28**, 372–381, April–June, 1946. 4 figs., 1 ref.

Pregnandiol glycuronide in urine was determined colorimetrically by a method involving 3 different types of estimation. The urine was first extracted with butyl alcohol at *p*H 10 and then washed with sodium hydroxide. It was then divided into 3 factions. (*a*) This was used during the normal luteal phase and at the beginning of pregnancy—the fraction was taken up in methyl alcohol and Tollens' colour reaction applied. The results were expressed in mg. of pregnandiol per 24 hours, and

gave an estimate of the total non-phenolic steroid glycuronides. (*b*) This estimation was carried out as described in the previous article after acetone precipitation. (*c*) This fraction was precipitated with ether, the estimation being based on the fact that the steroid glycuronidates are insoluble in ether, but soluble in methyl alcohol. Comparative estimations of creatinine were also performed. The results of estimation (*a*) and (*c*) were more reliable than those obtained by method (*b*), since this last method gave large errors during the final months of pregnancy.

Nine menstrual cycles were studied in one woman, and it was found that the pregnandiol glycuronide level increased from about 4 mg. at the beginning of the cycle to about 14 mg. at the end. During pregnancy the level increased sharply after 10 days (from the cessation of the last menstrual period) from about 5 mg. to 25 mg. at 30 days, at which level it remained until 50 days. It was concluded that the corpus luteum has a detectable increase of activity as early as the first 10 days of pregnancy, and that the chemical method of estimation employed afforded a good means of diagnosis in early pregnancy

R. Wien

8. **A Test for Determining the Time of Ovulation and Conception in Women.**

By E. J. FARRIS. *Amer. J. Obstet. Gynec.*, **52**, 14–27, July 1946. 1 fig., 30 refs.

The occurrence of ovulation is detected by the reaction of the ovary of the immature white rat to the urine of the patient. If ovulation is taking place the ovary becomes hyperaemic. A single tested strain of animals must be employed. Two ml. of urine passed on rising is injected subcutaneously into each of 2 animals. The rats are killed at the end of two hours and the ovaries removed, inspected, and the degree of redness compared with the colours of a Munsell colour chart. Reactions are classified as normal or abnormal, a normal reaction consisting of a deepening in colour of the rat ovary, on 3 or 4 consecutive days near the middle of the menstrual cycle. Reactions occurred earlier in shorter menstrual cycles. A number of patients experiencing normal reactions became pregnant, but none with abnormal reactions did so. Pregnancy occurred when coitus took place on the third or fourth day of colour reaction, but not when it was delayed until the reaction had disappeared. Urine assays showed that gonadotrophin was present at the time when the reaction was positive, thus correlating the observations with those of other authors who had shown a peak of gonadotrophin excretion at the time of ovulation. The 2-hour rat test is very sensitive to small amounts of gonadotrophin in the urine.

It is concluded that hyperaemia of the rat ovary in response to injection of urine from a woman in the mid-phase of the menstrual cycle is strong, though not conclusive, evidence that ovulation is occurring. The observation was checked by laparotomy in 1 case. The test is likely to prove of value in cases of sterility to determine the optimum time for coitus or artificial insemination. The third or fourth day of the colour reaction is the date on which insemination is likely to be successful. Technical details are important for success. The animals must be of a single tested strain and should conform to special limits for age and size. There should be standard lighting conditions for reading results.

Josephine Barnes

9. **Effect of Mucus Volume on Conception.**

By G. RAPS. *J. Amer. vet. med. Assoc.*, **109**, 275–276, October 1946. 7 refs.

Artificial insemination of cows is performed either by instillation deep into the cervical canal or by deposition of the semen just inside the os uteri; the latter is known as the "cervical splatter technique". Veterinary surgeons are divided as to the relative merits of the 2 methods. It has been argued against the second method that in cows with a large amount of oestral mucus secretion the semen would be carried out before impregnation occurred. An investigation was undertaken to see how far this theoretical objection was valid in practice. Cows vary greatly in the amount of the flow. They were classified as having little or none, a moderate amount, or a copious discharge. In over 2,000 inseminations the proportion of pregnancies resulting in the 3 groups was almost identical (46 to 49 per cent in each group). The author concludes that the amount of mucus has no effect on conception.

H. J. Croot

10. **The Receptivity of Cervical Mucus to Spermatozoa.**

By M. BARTON and B. P. WIESNER. *Brit. med. J.*, 2, 606–610, October 26, 1946. 3 figs., 13 refs.

The post-coital (Sims) test often shows, in cases of infertility, that the spermatozoa do not penetrate the cervical canal or, having penetrated, do not survive therein. This may be due to seminal deficiency or to abnormal cervical conditions, or to both. Cervical faults are not always apparent, and it is no longer possible to assume that the cervical mucus is receptive unless the post-coital test is positive. Semen and cervical mucus are virtually immiscible, and an interface is formed between them when they are in contact. Passage through the interface depends on the motility and penetrating power of the spermatozoa.

A simple test has been devised by which the process can be studied individually in special contact preparations, the receptivity of the cervical mucus being studied against fecund semen. Semen may also be assayed against normal cervical mucus obtained during the ovulatory phase. The technique of the method is described. It consists in making, on a glass slide, a capillary chamber charged first with cervical mucus and then with semen. The preparation is then examined under the microscope. A quantitative test may be made by using a circle 3 mm. in diameter drawn on the cover-slip, and counting the number of sperms entering and leaving the mucus per minute. Examination of normal specimens demonstrates the mechanism by which spermatozoa generally penetrate and survive in the cervical mucus. It is shown that mucus attracts sperms, and these congregate at the interfact. A decrease in sperm density is seen with distance from the interface. Sperms survive 12 to 48 hours at room temperature in slide preparations, not 4 to 5 days, as they do in the living cervix.

In abnormal cervical mucus, the interface is formed, but 6 fairly definite types of deviations from normal are noted. In some, sperms pass the interface, but after a time they lose motility. In others, sperms do not pass the interface, but congregate there. In certain other cases there is a deficiency of cervical mucus. Cervical mucus must thus, if fertility is to be assured, allow motility of sperms, sustain sperm life, and be susceptible to invasion. Faults in the cervical mucus are commonly a cause of infertility, and these results are closely correlated with those of the post-coital test. Infection, either general or local, or oestrogenic deficiency, may lead to abnormal cervical secretion. In cases of cervical infection the classical signs may be absent. Treatment has been attempted along 2 lines, by administration of oestrogens, either locally in the form of pessaries or by injection, and by the administration of sulphonamides in relatively small doses, sulphadiazine having been found to be the preparation of choice. An invasion test should be done in conjunction with routine semen analysis as part of the investigation of all sterility cases. [This is clearly work of great importance in the field of sterility.]

Josephine Barnes

11. **Hydrogen Ion Concentration of the Senile Vaginal Mucosa Before and After Estrogenic Therapy.**

By K. J. KARNAKY. *Sth. med. J.*, **39**, 906–907, November 1946. 1 ref.

PREGNANCY

NORMAL

Physiology

12. **The Relationship of Maternal Weight Gain to the Weight of the Newborn Infant.**

By J. KLEIN. *Amer. J. Obstet. Gynec.*, **52**, 574–580, October 1946. 12 refs.

13. **Estimation of Urinary Oestrone in Pregnancy.** (Le dosage de l'oestrone urinaire au cours de la grossesse.)

By C. MAYER. *Brux. méd.*, **26**, 1181–1189, October 6, 1946. 3 figs., 28 refs.

The biological and colorimetric methods for the estimation of urinary oestrogens are described and their limitations discussed. It is generally agreed that in pregnancy there is a considerable increase in urinary oestrogens, which appears to depend on the secretory activity of the placenta. A new method of extraction of urinary oestrone is described. A 24-hour specimen is collected and a certain volume is hydrolysed with hydrochloric acid to liberate oestrone. Sodium benzoate is added. This causes benzoic acid, which acts as an adsorbent, to be precipitated. After filtration and washing in distilled water the precipitate is dried, dissolved in ether, and the ethereal solution is added to 20 per cent caustic soda. This removes the benzoic acid, which is reconverted into sodium benzoate. The ethereal layer is separated and

evaporated leaving an oily residue containing all the oestrone. The latter is then estimated colorimetrically.

The level of urinary oestrone was measured in 10 cases of pregnancy, 7 of which were followed until after delivery. It was confirmed that there is a considerable rise in urinary oestrone during pregnancy. In non-pregnant women the highest level recorded was 120 μg. (1μg=10 international units). In 2 cases investigated at the sixth week of pregnancy, levels of 240 and 280 μg. were found. There is a gradual rise until at term levels of 2,400–4,200 μg. are found. There is considerable individual variation. One case of abortion at 4½ months is described. This case showed a much lower level of urinary oestrone than the rest at corresponding stages. This suggests that the placenta is responsible for the secretion of oestrone. Other evidence in favour of this is the sharp fall in urinary oestrone following parturition, and the general rough correlation between size of placenta and level of urinary oestrone.

R. Barer

14. **Permeability of the Placenta of the Guinea Pig to Inorganic Phosphate and its Relation to Foetal Growth.**
By W. S. Wilde, D. B. Cowie and D. B. Flexner. *Amer. J. Physiol.*, **147**, 360–369, October 1946. 4 figs., 11 refs.

15. **Permeability of the Human Placenta to Isoantibodies.**
By A. S. Wiener and E. B. Sonn. *J. Lab. clin. Med.*, **31**, 1020–1024, September 1946. 15 refs.

Diagnosis

16. **The Xenopus Pregnancy Test.**
By R. F. Milton. *Brit. med. J.*, **2**, 328, September 7, 1946. 13 refs.

The xenopus pregnancy test can now be accepted as a reliable method for routine work. The procedure is simple, and consists in injecting urine into the dorsal sac of the female toad *Xenopus laevis*, and watching for the appearance of the eggs. Its rapidity (6–18 hours) and its accuracy have been commented upon favourably. In addition, the toads may be used again in 3 months' time. On the other hand, the test has been criticized on the grounds that when the gonadotrophic excretion is low, as is often the case in early pregnancy, the normal test is not sensitive enough to indicate cyesis. As a larger quantity of urine kills the toad, the author evolved and here describes a method of concentrating the urine, thus overcoming this difficulty. The whole of the morning specimen of urine is filtered through a long glass tube containing specially prepared and cleansed permutit on to which the gonadotrophic hormone is adsorbed. Elution of the hormone is made with two washings of 5 per cent ammonia, and the combined elutions are inoculated in the usual manner. The technique, which has been used by the author for over a year, gives a positive result if the excretion of the hormone is greater than 500 I.U. a day, "a condition which rarely occurs in the absence of pregnancy." This method may also be used in a quantitative manner by graduation of the dose.

E. M. Darmady

17. **Frog Test (Xenopus Laevis) for Pregnancy.**
By C. B. Sanders. *Tex. St. J. Med.*, **42**, 375–376, October 1946.

Examination

18. **The Use of X-rays in Obstetrics plus a Presentation of some Medicolegal Aspects.**
By L. J. Gelber, *Med. Rec., N.Y.*, **159**, 663–667, November 1946. 14 refs..

Nutrition

19. **Vitamins in Obstetrics and Gynaecology.**
E. Y. Yankelevich. *Pediat. Akush. Ginek.*, No. 4, 24–32, 1946.

This article is a summary of the properties and dosage of and indications for the administration of vitamins A, B_1, C, D, E, and K in obstetrics and gynaecology. It is stressed that the pregnant woman requires two or three times the normal number of units. The author considers that particularly important are: (1) vitamins A, B_1, C, D in both normal and abnormal pregnancy and in the puerperium (an interesting observation is that in spontaneous abortions only 20 per cent of foetal livers were found to contain any vitamin A, while in abortions induced artificially 100 per cent of foetal livers contained a store of vitamin A); (2) vitamins B_1 and K immediately before and during labour; (3) vitamins C and K in haemorrhagic disease of the new born; and (4) vitamins A, C, and K in gynaecology, especially in the treatment of uterine haemorrhages and cervical erosions.

N. Tereshchenko

20. **Weight Control, Diet and Fluid Balance in Pregnancy.**

By C. H. LOUGHRAN. *Amer. J. Obstet. Gynec.*, 52, 42–53, July 1946. 4 figs, 7 refs.

The majority of women who gain weight excessively in pregnancy develop toxaemia or dystocia. Those who gain little weight have a shorter labour and fewer obstetrical complications. Deprivation has little effect on the weight of the baby. Pregnant women need more protein than normal. Exercise is important for body function. The effect on the mental well-being of the patient is important.

A regime of weight control in pregnancy has been employed in 325 consecutive private cases. At first, a total gain in weight of 20 lb. (9.0 kg.) was allowed, but this was later reduced to 15 lb. (7.7 kg.). In obese patients the ideal was no gain at all. A diet high in protein, green vegetables, fruit, and milk, but low in carbohydrate was given with vitamin supplements. Salt was restricted in the later months. Patients gaining beyond their allowance were put on a 1,200 calorie diet. Fluids were restricted in cases with a sudden gain in weight. If oedema and hypoproteinaemia occurred, the patient was admitted to hospital and put on a very high protein diet, supplemented with infusion of plasma.

Results in the 325 cases showed only 2 patients who developed oedema, 1 with heart disease and 1 with nephritis. There was 1 case of post-partum eclampsia, but the general incidence of toxaemia was greatly reduced. There was a marked reduction in obstetrical complications. There were no maternal deaths but 5 stillbirths (a rate of 1.53 per cent), none being attributable to delivery. There were 2 neonatal deaths. A definite relationship is shown between the amount of weight gained and the length of labour and the occurrence of dystocia. A similar relationship between weight gained and the incidence of toxaemia is demonstrated. The author considers that the earliest evidence of toxaemia is an excessive gain in weight, and that a regime of weight control in pregnancy will reduce the incidence of this and other complications of pregnancy and labour.

Josephine Barnes

21. **The Effect of Antenatal Conditions on the Newborn Child. I, Maternal Diet. II. Nutritional State of the Mother. III. The Health of the Mother.**

By L. G. PARSONS. *Canad. med Ass. J.*, 55, 327–336, October 1946.

22. **Some Observations on the Role of Protein in Pregnancy.**

By E. M. BLAIR. *West. J. Surg.*, 54, 288–293, July 1946. 12 refs.

See also Nos. 6, 7.

ABNORMAL

Toxaemias

23. **Genetical Antigenic Incompatibility as a Possible Cause of the Toxaemias Occurring Late in Pregnancy.**

By H. KALMUS. *Ann. Eugen., Camb.*, 13, 146–149, August 1946. 6 refs.

If eclampsia is like erythroblastosis foetalis in being dependent on an antigenic incompatibility between mother and foetus, certain peculiarities should occur in the pedigrees of affected women. For instance, a woman who, as a foetus, caused toxaemia in her mother, will only rarely have it herself, while a woman who herself has toxaemia is unlikely to have caused it in her mother. A man who, as a foetus, has caused toxaemia in his mother is relatively likely to cause it in his wife; and conversely, the husband of a toxaemic woman is relatively likely to have caused toxaemia in his mother. Toxaemia should be likely to recur in subsequent pregnancies. Toxaemia would always be more frequent in the sisters of a toxaemic woman, and in her husband's brothers' wives than the general population [little attention has been paid to the latter degree of relation in previous genetical studies]. Other peculiarities of the pedigrees would depend on the relative frequency of the antigen in question, if such in fact should exist.

[The direct evidence for or against the existence of an antigenic difference to account for eclampsia is so far very scanty. The paper draws attention to the points which should be kept in mind in collecting critical data on the problem.]

H. Grüneberg

24. **An Investigation of the Human Placenta for Pressor Substance.**

By T. E. T. BRADSHAW. *Irish J. med. Sci.*, 235–241, July 1946. 14 refs.

The author first discusses the current hypotheses concerning the production of pressor substance, hypertensin (angiotonin), by the interaction of renin with hypertensinogen (globulin). He con-

cludes that renin is present in normal mammalian kidneys and that rendering a kidney ischaemic releases renin into the blood stream producing hypertension. The experimental work deals with an investigation into the possibility that renin might be present in the placentae of cases of eclamptic toxaemia. Its liberation might be responsible for the rise in blood pressure.

Pig-kidney extracts were prepared to ensure that the method of extraction of renin was efficient. Cortices of kidneys were ground to a paste and shaken with alcohol, and the mixture was allowed to stand 24 hours in a refrigerator. Alcohol was filtered off and the residue washed with ether and allowed to dry at room temperature. The ground material after drying was stored in a refrigerator. Placental extraction was made in the same way, 50 g. being used for each extraction. The method of testing for renin was to inject a Ringer's solution extract intravenously into a rabbit and to observe the effect on blood pressure, a rise indicating the presence of renin.

The blood pressure of a non-anaesthetized rabbit (the animal being kept warm) was measured by using a capsule of the design by Grant and Rothschild placed over the central artery of the ear. The systolic blood pressure was measured by raising the pressure in the capsule till the artery just stopped pulsating. The position of the capsule was important as a wide variety of readings was obtained depending on whether the capsule was on the distal or proximal portion of the artery. Material for injection was prepared by shaking a weighed quantity of dried material with Ringer's solution and allowing it to stand overnight in the refrigerator. The material was centrifuged and the supernatant fluid filtered. (The maximum amount injected was 1 ml.) Before testing a sample, blood pressure readings were taken till constant, usually after about 10 minutes. Six different kidney extracts prepared from 0.6 to 1 g. dried kidney powder extracted with 10 ml. Ringer's solution all showed the presence of renin. Placental extracts from normal pregnancies occasionally caused a minor ill-sustained rise in blood pressure. Renin was presumed not to be present. Placental extracts from cases of pre-eclamptic toxaemia also did not cause a rise in blood pressure and there was, therefore, no evidence of the presence of renin in these extracts.

J. Dawson

25. **Spontaneous Rupture of the Liver in Eclampsia with Fatal Hemoperitoneum.**

By S. Sanes and C. A. Kaminski. *Amer. J. Obstet. Gynec.*, **52**, 325–329, August 1946. 3 figs., 4 refs.

The authors describe a case of eclampsia which terminated fatally from rupture of the liver. The disease was typical in all respects, occurring in a multiparous negress at about the thirtieth week of gestation. Treatment was on the usual lines with intravenous glucose, magnesium sulphate, morphine, and a salt-free diet. Labour was induced by insertion of a bougie, rupture of the membranes, and packing the vagina. The only abnormal feature was the rapidity of delivery, 12 hours later, when the foetus, bougie, and plugging were expelled by one strong sustained contraction. After delivery the patient appeared drowsy, her general condition deteriorated, and collapse and death occurred 16 hours later with signs of internal haemorrhage. Necropsy revealed the usual changes of eclampsia with, in addition, a massive intraperitoneal haemorrhage originating from a rupture of the anterior superior capsule of the liver. The liver in this region was covered by a large subcapsular haemorrhage. The final precipitating cause for the haemorrhage is discussed, and it is suggested that the rigidity of the costal margin may have a bearing on the site of the lesion. Five similar cases from the literature are abstracted, and in each of which rupture of the liver occurred from diffuse subcapsular haemorrhage.

R. B. K. Rickford

26. **Necrosis of the Adrenal Cortex and Anterior Lobe of the Pituitary in Pregnancy.** (Uber Nierenrinden- und Hypophysenvorderlappennekrose bei Gravidität. Ein Beitrag zur Morphologie der Eklampsie.)

By W. Hügin. *Gynaecologia*, **121**, 269–287, May—June 1946. 4 figs., 74 refs.

Renal cortical necrosis is a well-recognized complication of pregnancy, and the author reviews the literature of 50 of the recorded cases and also that relating to necrosis of the pituitary gland. He describes 2 cases in detail of the association of both lesions, a condition hitherto unrecorded. In each case there was antecedent toxaemia of pregnancy; eclampsia developed in one patient, while the other had premature detachment of a normally-sited

placenta. There was subsequent anuria, and the patients died in spite of decapsulation of the kidneys. Pathologically, necrosis of the renal cortices and anterior lobes of the pituitary was found, the changes being less pronounced in the eclamptic patient. Besides necrotic changes in the epithelium there was extensive thrombosis and infarction.

Kenneth Bowes

27. **Treatment of Eclampsia by Intravenous Magnesium Sulphate Alone.** (Traitement exclusif de l'éclampsie par le sulfate de magnésie en voie intraveineuse.)

By M. F. ARMAND. *Obstet. Ginec. latin-amer.*, 4, 410–424, June 30, 1946. 8 refs.

Stroganoff's method of treating eclampsia can be summarized as follows. (1) Narcotics and sedatives —that is, morphine and chloral hydrate—to quieten the nervous excitability and diminish the cerebral oedema. (2) Bleeding and drastic purgatives to eliminate the general oedema. (3) Glucose-serum to combat the intoxication. His results are good, maternal mortality being reduced to 2.6 per cent, and infant mortality to 16 per cent. Lazard's method consists in: (1) Intravenous injection of magnesium sulphate (10 per cent solution) in doses of 20 ml. when the patient's condition requires it, up to a maximum of 90 ml. (2) Extraction of the foetus by forceps if the woman is in the second stage of labour. (3) Oxygen inhalations after each fit. (4) Caesarean section if necessary. (5) Intravenous glucose-serum in 10 per cent strength if there is little oedema, in 50 per cent strength if there is much oedema. His results are also very good, maternal mortality being 0.6 per cent, and infant mortality 46.6 per cent. Browkin's method is more complicated: (1) Intramuscular injection of a 30 per cent solution of magnesium sulphate, 20 ml. at a time, up to 5 injections in the 24 hours. (2) Nothing to drink by the mouth except a little very sweet water. (3) Intravenous injection of 100 ml. of 10 per cent glucose-serum if coma occurs. (4) Administration of saline purgatives. (5) Lumbar puncture. (6) Ether anaethesia for the injections if the patient is very restless. (7) Application of forceps as soon as possible, and extraction of the foetus. (8) Bleeding if the fits are severe. His results are excellent; the maternal mortality is 2.1 per cent and the infant mortality 6.1 per cent.

As the pathology of eclampsia is that of severe water intoxication aggravated by spasm of the arterioles, the author considers that rational treatment consists in employing a powerful antispasmodic and diuretic drug. Magnesium sulphate is the ideal substance for the purpose; it effectively reduces the blood pressure, it produces diuresis rapidly, and reduces oedema of the tissues through its hygroscopic action; it has in addition a narcotic and anaesthetic effect with the advantage of not paralysing the uterine musculature. Finally it does not reduce the alkaline reserve of the blood. The author uses a 50 per cent solution, and injects intravenously 10 ml. (5 g. of salt) of the solution as soon as eclampsia or a pre-eclamptic state is diagnosed, followed by 5 ml. of the solution (2.5 g. of the salt) every 4 hours until return to normal. He also advises a daily dose of 5 ml. so long as headache is present or the blood pressure remains high or tends to rise. The solution must be injected very slowly after being mixed with an equal amount of the patient's blood. The patient frequently complains of a feeling of general warmth, and exhibits slight excitement; this disappears on momentarily stopping the injection, and resuming it more slowly than previously. Sweating often occurs very rapidly, and urine is passed within half an hour; the blood pressure falls immediately by 30 to 60 mm. Hg. No sedatives or any other drugs are given, and no anaesthetic is necessary to control the convulsions; the action of magnesium sulphate in that respect is instantaneous.

A full account of 21 cases is given. Seventeen patients were actually having convulsions on admission, 5 of them being in coma. Eighteen were primiparae and 3 multiparae. Five patients developed eclampsia during pregnancy, 4 during labour, and 12 in the puerperium. There were no maternal deaths; in the 5 cases treated before labour, 3 infants survived and 2 died; in the 4 treated during labour, 2 infants were stillborn, the other 2 survived. The largest total dose of magnesium sulphate injected intravenously exceeded 50 g. There were severe reactions in 3 cases only (shock and syncope, responding rapidly to injection of camphor in oil), all of which had a high blood chloride.

N. N. Tereshchenko

See also Nos. 20, 30.

Abortion, Hydatidiform mole

28. **Sodium β-Glycerophosphate in Obstetrics.** (Betaglicerofosfato sódico y obstetricia.)
By M. RONCALES CATIVIELA. *Farmacoter actual.* 3, 474–478, July 1946. 14 refs.

The author reports 25 cases of threatened abortion treated with sodium beta-glycerophosphate, which acts by inhibiting uterine tone. The treatment was effective in 19 out of the 25 cases. The dose was 10 ml. of a 50 per cent solution injected intravenously. Repeated doses were given without evidence of toxic effects. The uterus remained sensitive to the action of oxytocin and the liquid extract of ergot.

H. M. Adam

29. **The Aetiology of Spontaneous Abortion.** (Etiologie de l'avortement spontané (en dehors de la syphilis.)
By R. L. ROCHAT. *Gynéc. Obstét.*, 45, 299–336, 1946. 86 refs.

30. **Hydatidiform Mole, with Special Reference to Recurrence and Associated Eclampsia.**
By L. C. CHESLEY, S. A. COSGROVE, and J. PREECE. *Amer. J. Obstet. Gynec.*, 52, 311–320, August 1946. 79 refs.

In this paper the authors describe a case of recurrent hydatidiform mole with severe toxaemia on each occasion. The literature on this association is exhaustively reviewed. Finally, 57 consecutive cases of hydatidiform degeneration of the chorion occurring at the Margaret Hague Maternity Hospital, Jersey City, U.S.A., among 75,238 deliveries (1 in 1,321) are analysed.

The case described is one in which the first pregnancy resulted in a hydatidiform mole, complicated by severe pre-eclampsia. Three normal pregnancies followed, one, however, requiring a manual removal of the placenta, and another a Caesarean section for placenta praevia. The fifth pregnancy again led to a hydatidiform mole with eclampsia, followed later by chorionepithelioma. The first pregnancy terminated spontaneously after 6 weeks' hospitalization for severe albuminuria and hypertension. The uterus was explored digitally after delivery. The Friedman test was negative 2 weeks after delivery, but was positive 3 months later. Curettage was carried out but revealed nothing more than "chronic endometritis". The fifth pregnancy, complicated by 5 eclamptic fits, was terminated by a bag induction followed by digital clearance of the uterus. The Friedman test was negative 3 weeks later, but weakly positive at 5 weeks. Curettage confirmed the presence of "atypical chorion-epithelioma" and a panhysterectomy was carried out. Both ovaries were enlarged and cystic, and one had undergone torsion and was degenerated. [No microscopy of the ovaries is reported.] Ten months later the patient was very well, but was unfortunately accidentally killed with her whole family on leaving the hospital.

The authors in their review of the literature found 40 cases of recurrent hydatidiform mole, and 35 cases of this type of pregnancy complicated by eclampsia. Of the 57 cases occurring at the Margaret Hague Maternity Hospital, 21 per cent were diagnosed before expulsion of vesicles. In 4 cases cystic ovaries were present. An analysis of the symptoms revealed that 96.6 per cent were complicated by bleeding. The uterus was either larger, of normal size, or smaller than expected, in about an equal number of cases. The Friedman test was positive in all cases tested (11), and positive in dilutions up to a maximum of 1 in 9,000 in the cases where this test was applied. Pre-eclampsia occurred in 9 out of the 25 cases over 16 weeks pregnant, but was absent in the 32 patients with a shorter gestation. Five moles were removed abdominally, 4 manually, 13 by curettage, 1 by sponge stick, and the rest were expelled spontaneously. The Friedman test became negative at varying dates postpartum, the latest not for 7½ months. In one case it was positive in dilution of 1 in 50 as late as 4 months after, without the presence of malignancy. Three cases only were followed by chorionic carcinoma [a percentage considerably lower than is usually expected]. In one of these (reported in this paper) the pregnancy test was only weakly positive.

[This is an excellent and interesting paper on the subject of hydatidiform mole and chorionepithelioma. The diseases are rare and dramatic. It should always be remembered when dealing with toxaemia of pregnancy occurring before 16 weeks that there is a great probability of the presence of a hydatidiform mole.]

R. B. K. Rickford

Association with Systemic disease

31. **Thyrotoxicosis and Pregnancy.**
By R. C. STEPTO *West. J. Surg.*, 54, 317–319, August 1946. 18 refs.

32. **Diabetes mellitus and Pregnancy: a Review.** By N. J. EASTMAN. *Obstet. Gynec. Surv.*, **1**, 3–31, February 1946. 98 refs.

Association with infections.

33. **Syphilis in Pregnancy: Preliminary Report on a Tyneside Investigation.**
By W. V. MACFARLANE. *Publ. Hlth., Lond.*, **59**, 181–185, September 1946. 6 refs.

In 1943 a scheme was introduced in Tyneside whereby all pregnant women attending antenatal centres were encouraged to undergo a Wassermann test. Those in whom a positive result was reported were advised to attend a venereal disease department for further examination. A diagnosis of syphilis was not made until there was a persistent, strongly positive reaction. The syphilitic pregnant women thus discovered, most of whom attended in the later months of their pregnancy, were then placed on a routine treatment of 10 injections of neoarsphenamine and 10 injections of bismuth metal suspension.

In the years 1944 and 1945 the number of live births recorded in Tyneside was 52,000, and 80 per cent of the mothers had attended at an antenatal centre. On account of war-time difficulties the Wassermann test was actually performed on only 24,638 of the women; it is of interest to note that about 1 per cent of the women refused the test. A strongly positive reaction was obtained in 201 women, and in a further 68 it was doubtful; approximately half of the latter number were subsequently found to be non-syphilitic. The number of women who were referred to a venereal diseases clinic was 175, but the report deals mainly with the further history of the 115 who actually attended. Twelve women were still pregnant at the time of reporting, and are excluded from the analysis.

In an attempt to discover why some women failed to co-operate with the clinic the author points out that 84 of the 103 women were in the asymptomatic latent stage of syphilis, in which the absence of symptoms might well make it difficult for them to realize the need for treatment. The highest defaulter rate was experienced in the 22 to 25 age-group, though the incidence of default did not vary in proportion to the different ages. Both these factors may have had some influence on the rate of default; they do not fully explain it. Excluding 16 women who attended too late in pregnancy to receive adequate treatment, there were 87 who had the opportunity to avail themselves of it, but only 37 did so, in spite of very active efforts at follow-up (tabulated in detail) by the local authorities' health visitors and by the staff of the venereal diseases social departments. Another reason for irregular attendance suggested by the figures given, although not stressed by the author, is the comparatively late stage of pregnancy of many women on first attendance at the venereal diseases clinic. The report contains tables of the outcome of the pregnancy in the 103 women, and the results of adequate and inadequate treatment are contrasted. Some dissatisfaction is expressed at the results of the scheme, and reasons for default and measures to improve co-operation by the patient are discussed. When repeated voluntary efforts have failed compulsion would appear to be the only solution to the problem of default.

[The word "default" is here used as relating to the interruption of regular attendances at the venereal diseases clinic. Sixty out of the 175 women having a positive Wassermann reaction who were referred to a venereal diseases clinic did not attend there at any time. The further steps taken and the difficulties encountered with these "primary losses" are not made clear in the report.]

V. E. Lloyd

34. **The Prevention of Syphilis in the Newborn.**
By C. N. FRAZIER. *Tex. St. J. Med.*, **42**, 372–374, October 1946. 14 refs.

See also Nos. 21, 48–52.

LABOUR

35. **The Risks of the Induction of Labour by Aburel's Method.** (Los riesgos de la induccion del parto con el metodo de Aburel.)
By M. L. PÉREZ and E. M. BALDI. *Rev. méd.-quirúrg. Pat. fem.*, **25**, 179–192, June 1946. 3 figs., 45 refs.

Among the numerous methods of induction of labour that of Aburel (intra-amniotic injection of hypertonic saline) has recently found favour and has been described as relatively safe for mother and foetus. Several disasters have been reported, however, and a list of these is given. Foetal death seems to be the commonest, and the author concludes that the method is risky to the foetus.

Twenty-five cases of induction of labour by Aburel's method are described. In these there were 11 foetal deaths. Three cases are described in detail. In the first, induction was undertaken after the death of the foetus. The mother died, and at necropsy an intense necrosis of the uterine muscle was found, with evidence of acute inflammation. There was also a peritonitis. It is suggested that the solution was inadvertently injected into the uterine muscle. In the second case, one of eclampsia with intrauterine foetal death, the mother also died of peritonitis. In the third case, one of eclampsia, the child was born with a gangrenous condition of the right foot. It is concluded that this is a dangerous method of induction, but that the danger may come from the solution used. Other solutions, such as 25 per cent glucose, should be given clinical trial before the method is abandoned. [Intra-amniotic injections have never found favour in Britain for the induction of labour. It is well that the inherent dangers of the method, some not apparent and thus only discovered after clinical trial, should be made known.]

Josephine Barnes

36. **Effect of Antispasmodics on Dilatation in Labour.** (Einwirkung von Spasmolytica auf die Eröffnungsperiode bei der Geburt. (Untersuchung eines neuen Mittels " Hexacompal ".))

By H. SAUTER. *Gynaecologia*, **121**, 247–268, May–June, 1946. 18 figs., 4 refs.

The effects of pethidine, spasmalgin, and a new preparation, " hexacompal ", on spastic conditions of the uterus in the first stage of labour were studied by the author. Hysterotonography was used particularly to show the actions of the drugs on the amplitude of the contractions, the effect on the tonus during the phases between contractions, and the regularity of the contractions. Hexacompal was deemed to have the best action. It contains papaverine, extract of belladonna, allobarbitone, caffeine, and dimethylaminoantipyrine, i.e., it is allied to spasmalgin, but contains no pantopon. Administered rectally by suppositories [no dosage given], its effect becomes well marked in 10 to 15 minutes, and action is sustained for an hour or longer.

The indications for its use are non-dilatation of the os in the presence of good pains, a rigid cervix, painful contractions, and pain continuing between the contractions. Hexacompal made these spastic conditions disappear rapidly, and the first stage of labour was accelerated. There were no secondary effects noticed on either mother or child. The tonus of the uterus between pains was noticeably greater with hexacompal than with pethidine or spasmalgin. Contra-indications to the use of the drug were premature pressure on the deeply engaged head and induction of labour with poor contractions.

Kenneth Bowes

37. **The Effect of Pethidine on Labour.** (L'effet de la dolantine sur l'accouchement.)

By F. DE SENARCLENS. *Gynaecologia*, **121**, 225–246, May—June 1946. 54 refs.

Pethidine is a synthetic substance combining an anti-spasmodic action of a neurotropic type with an analgesic action like that of morphine. By its vago-depressive action it is particularly useful in helping dilatation of the uterine os. Since Benthin used the product in 1938, and published his observations in 1940 (*Dtsch. med. Wschr.*, **28**, 760), various papers on the subject have appeared, and most authorities have been in favour of its use as it has little adverse effect on the baby. Erbslöh (*Zbl. Gynäk.*, 1943, **14**, 578), however, does report 4 cases of marked asphyxia in 250 confinements in which pethidine was used.

The author follows Döderlein's technique, injecting 100 mg. intramuscularly and repeating this dose if necessary later, but not within 4 hours. It should not be used late in the second stage of labour. It was given in 167 cases, 127 being primigravidae, and 40 multigravidae. Sixty-one patients were below 25 years old, 85 from 26 to 35, and 21 over 35. A detailed analysis is given of their skeletal types, external pelvimetry, etc. Cases included pelvic contraction, and diseases coincident with pregnancy.

The author concludes that in normal labour pain was considerably relieved and labour accelerated. He tried the preparation particularly in cases of rigid os, abnormal contractions of the lower segment, and when the contractions were too frequent or prolonged. He was impressed by its effect in spastic conditions. There were no marked untoward effects. One baby had white asphyxia and one blue. An oxytocic was needed as well for 13 per cent of the patients. Additional anaesthesia proved no handicap. No observation is made in regard to third-stage bleeding.

Kenneth Bowes

38 The Clinical Diagnosis of Varying Degrees of Uterine Contraction Rings.

By H. W. JOHNSON. *Amer. J. Obstet. Gynec.*, 52, 74–82, July 1946. 7 figs., 5 refs.

An apparent difference in the incidence of uterine contraction ring as a cause of dystocia is found between the author's practice and the practice of two hospitals in Houston, Texas, the difference being due to the author's greater interest in, and awareness of, the condition. It is well known that a physiological ring develops in normal labour at the junction of the upper and lower uterine segments. The terminology of the pathological varieties remains confused and bewildering. The author accepts the classification given in the *Standard Nomenclature of Diseases and Operations*, and is convinced that rings occur in both obstructed and unobstructed labours, and when present are obstacles to the progress of labour.

In the first group obstruction to the passage of the foetus causes development of contraction ring, and the degree of ring formation is dependent on the degree of obstruction. In the second group the ring causes obstruction to the passage of the foetus. It is with the second group that the author is mainly concerned, and he divides them into mild and severe. The mild type may develop early in the first stage of labour or not until almost the end of the second stage. Premature rupture of the membranes is believed to predispose to this condition. Diagnosis is made on account of the colicky nature of the pains, and in cases where the ring forms early in labour on the fact that the cervix does not dilate. The author emphasizes that "the cervix will always dilate when labour pains are adequate but only very slowly in unobstructed labours where a contraction ring is forming or has formed." Later the diagnosis may be confirmed by passing a finger through the cervix, between the uterine wall and the head, and noting that when the upper part of the uterus contracts strongly the impact on the examining finger is weak.

Treatment is expectant until the cervix is 4 cm. dilated. Then the patient is anaesthetized, episiotomy is performed, the cervix pushed gently over the head, and the lower segment explored. If no loop of cord is encountered mid-forceps is applied and delivery accomplished, with deepening of anaesthesia if necessary. If the cord is present in the lower segment, version and extraction are performed. Adrenaline is useless for this type of ring, but deep ether or chloroform anaesthesia will relax it.

[Amyl nitrite, which has been used with success in treatment of contraction ring, is not mentioned in this article. It is doubtful whether such radical methods of treatment as those outlined for the treatment of mild cases of contraction ring dystocia would find favour in most clinics.]

Josephine Barnes

39. Use of Methergine in the Third Stage of Labour. (Effets et rôle de la méthergine au cours de la période placentaire de l'accouchement.)

By J. P. D'ERNST. *Schweiz. med. Wschr.*, 76, 775–777, August 24, 1946. 7 refs.

It was shown by Jacobs and Craig in 1934 that the products derived from ergot of rye all contain a particular acid, which they named lysergic acid. Methergine is a new, semi-synthetic substance, methylergobasine (methylergometrine) M.E. 277 (2-butanol-amide of *d*-lysergic acid).

An outline is given of the methods in current use for the management of cases of post-partum haemorrhage at the Obstetrical Clinic at Geneva. Ergometrine (known as basergine in Switzerland) was extensively used and was found to act rapidly, but its action was of short duration. If given before the birth of the placenta, it rarely led to satisfactory delivery, and symptoms of intolerance, such as headache, vertigo, and vomiting, were often seen. Methergine was given a clinical trial in 100 cases, as a possible alternative to ergometrine. It was given in a dose of 0.2 mg. either during the passage of the head over the perineum, or at the moment of appearance of the anterior shoulder, or immediately after the birth of the child. The injection was given intravenously whenever possible, and before the birth of the child. Observations were on the amount of blood loss, on the interval before contraction of the uterus, and the interval before delivery of the placenta. It was found that the uterus contracted briskly 35 to 50 seconds after injection in most cases, that the average duration of the third stage of labour was 8 minutes 6 seconds, and that the average loss of blood was 176 ml. It was found that the usual signs of placental separation were absent, but that in spite of this, delivery was easily accomplished in every case. Retention of placental cotyledons was not seen, though reten-

tion of membranes occurred in some cases. No symptoms of intolerance were found, and the puerperium was comparable to that experienced by a control group of women delivered of the placenta spontaneously. Methergine is contra-indicated in cases where a moderate loss of blood may be considered advantageous, including cases of severe toxaemia with high blood presure, eclampsia, and renal disease with hypertension. In twin pregnancy, the injection should not be given until after the birth of the second infant. Intramuscular injections gave much less satisfactory results.

It appears that the administration of methergine for prevention of post-partum haemorrhage is a useful procedure and it is one worthy of extended trial. [Many substances have been introduced in an attempt to shorten the third stage of labour and to diminish post-partum haemorrhage. In Britain the general feeling is against using oxytocic drugs before the birth of the placenta, though some use oxytocin, and others even ergot preparations. The chief complication feared is contraction ring. This has not occurred in the present series with methergine but the numbers are small, and clearly more extended trials are needed, under expert supervision, before the method can safely be recommended for routine use.]

Josephine Barnes

40. **A Placenta Accreta.**
By H. H. SKINNER. *Med. Rec. N.Y.*, **159**, 677–678, November 1946.

ANAESTHETICS, ANALGESIA

41. **Intravenous Pentothal Anaesthesia in Obstetrics, with Pitocin Injections.** (Accouchements sous anesthésie au pentothal intraveineux avec pitocin.)
By M. A. BOUDREAU. *Un méd. Can.*, **75**, 903–906, August 1946. 8 refs.

A case is described in which intravenous pentothal was given late in labour and followed with a dose of pitocin. The result was a rapid delivery with immediate recovery of consciousness. It was decided to try the method in a series of cases. A small dose of pentothal was found to enhance uterine contractions; larger doses, however, caused them to cease. There was amnesia after pentothal. In 1 case it was found that profound anaesthesia with cessation of uterine contractions appeared. Two injections of 1 ml. each of pitocin were given without effect. Later 5 ml. of a 1 in 20 solution of pitocin was given intravenously, with the result that 3 contractions occurred and a low-forceps delivery was possible. After this the pentothal and pitocin were mixed in one syringe, 1 ml. of pitocin to each 20 ml. of a 2.5 per cent solution of pentothal.

The method was tried in 239 cases, including 69 primiparae Results were good—no maternal mortality and only 3 foetal deaths. The injection was begun when the os was fully dilated, or dilatable. The first injection was of 5 to 8 ml., and this was repeated up to 3 times if necessary. Episiotomy was performed in primiparae, and forceps applied after the third injection if delivery had not taken place. Forceps delivery was required in 19 out of the 69 primiparae. The third stage of labour was usually rapid. Contra-indications included inability of the cervix to dilate, non-engagement of the head, any obstruction to normal delivery, and the previous use of another barbiturate. Advantages claimed are that anaesthesia and analgesia were rapid, delivery expeditious, recovery rapid, and the anaesthetic non-inflammable. Disadvantages include the necessity to await full dilatation and the risk of rupture of the uterus.

[This appears to be a highly dangerous method of conducting labour, in spite of the good results claimed in a relatively small series of cases. The depressing effect of pentothal on the foetal nervous system is well known. The forceps rate in primiparae is nearly 30 per cent, and the author admits, though with some qualification, the risk of uterine rupture. These are only 3 of the many possible dangers inherent in the method. There are better and safer ways of conducting normal labour, with satisfactory analgesia and anaesthesia when required.]

Josephine Barnes

42. **Intravenous Procaine for Obstetrical Anaesthesia.**
By K. JOHNSON and C. R. A. GILBERT. *Curr. Res. Anesth.*, **25**, 133–146, July–August 1946. 3 refs.

There are two stages in intravenous procaine for obstetrical anaesthesia: (1) Small dose; rate of infusion usually about 1 ml. per minute of 1 per cent solution (varied from 0.6 to 1.6 ml.); patient remains conscious and mentally clear; pain is much

reduced or abolished. (2) Large dose; rate of infusion usually 16 to 20 ml. per minute; pain is abolished; patient is semi-conscious and usually co-operative.

Twenty labour cases are described by the authors, the ages of the patients ranging from 15 to 31 years. Eighteen of them had nembutal per os; the 2 who did not were admitted late in labour, and were started immediately upon large-dose procaine infusions. The others were started upon small-dose infusions, their stage of dilatation ranging from 1 to 8 cm. The authors recommend a barbiturate as a preventive for the tendency to convulsions caused by intravenous procaine. All the children were born living, and only 1 required resuscitation, and that was in the case which had the smallest total dose of procaine (0.3 g.). Quick recovery (about 5 minutes after large doses) and lack of after-effects were striking features. Very large total amounts were used. Seven of the cases had over 5 g. and the largest dose was 9.7 g. The usual procedure was for the small-dose method to be used in the earlier stages of labour, and then, when delivery drew near, for the flow to be quickened until semi-consciousness and mental confusion were produced. Immediately after the end of the second stage the patient was allowed to recover, but the anaesthesia was deepened again if repair of the perineum or repair of episiotomy was needed. Six of the patients had some symptoms of toxaemia, 4 of these had twitchings of the face during the rapid infusion. In 2 the method was abandoned for fear of convulsions, ether being given for the delivery. One of them had post-partum eclampsia.

In all cases a 1 per cent solution was used. Procaine 10 g. was dissolved in a little water, sterilized, and then made up to 1 litre with 5 per cent glucose solution. This is used instead of saline to avoid risks of oedema. Every patient is tested for procaine sensitiveness by injecting a drop of 2 per cent solution intradermally and waiting at least 15 minutes; if the result is negative or doubtful a drop can be instilled in one eye for further verification if desired.

The authors state that the 20 cases described, added to the 12 previously reported, make up a series of 32 without a death or serious accident; that though this experience is encouraging as regards safety to mother and child, it is obviously a small basis for recommendation of a new anaesthetic method, and prudence and reservation are still necessary; and that the simplicity of the method makes it available to every physician.

[The authors describe their test for procaine sensitivity, but give no indication of what happens if the test is positive. They also do not mention a difficulty which one would think likely to occur—i.e., the difficulty of keeping a needle in a vein for many hours during the various stages of labour.]

W. Stanley Sykes

43. **Analgesia in Obstetrics: A Comprehensive Review.** (L'analgésie obstétricale.)

By J. Snoeck and M. Rocmans. *Gynéc. Obstét.*, 45, 257–287, 1946. 5 figs., 38 refs.

PUERPERIUM

44. **The White Cell Count and the Sedimentation Rate in the Uncomplicated and Afebrile Puerperium.** (Untersuchungen uber das Verhalten des weissen Blutbildes und der Blutsenkungsgeschwindigkeit im fieberfreien ungestörten Wochenbett.)

By F. Perabo. *Gynaecologia*, 122, 16–52, July-August, 1946. 7 figs., 42 refs.

Variations in the leucocyte count, sedimentation rate, and haemoglobin percentage of the blood were observed in 200 cases of the uncomplicated and afebrile puerperium. Examinations were made before delivery and on the fifth, ninth, twenty-first, and forty-second days postpartum. Statistically the results were examined by the arithmetic mean, the mean quadratic deviation, and the variation coefficient. Before delivery the white cell count averaged 12,100 per c.mm. This fell to 7,900 on the fifth day and to 6,900 on the ninth. A rise of 1,000 per c.mm. during the puerperium proved an indication of some casual complication and was never a sign of the puerperal state itself. In general there was a similar response in the differential cell count though the lymphocytes fell to about half their proportion present before birth. A drift to the left in the white cell count before labour was rapidly compensated for in the puerperium. The sedimentation rate rose to 50 mm. before labour and was followed by a slow restitution in the puerperium with a value of up to 15 mm. 6 weeks postpartum. The haemoglobin averaged 80 per cent before delivery and 75 per cent on the fifth day of the puerperium. The influence of the haemoglobin value on the sedimentation rate was not obvious.

R. K. Bowes

45. **Puerperal Infection.**
By J. H. E. WOLTZ. *Amer. J. med. Sci.*, **211**, 743–751, June 1946. 81 refs.

46. **Pathogenicity of Group C (Lancefield) Haemolytic Streptococcus.**
By R. I. HUTCHINSON. *Brit. med. J.*, **2**, 575–576, October 19, 1946. 6 refs.

One hundred and five Group C strains of haemolytic streptococci were recognized among 970 groupable strains isolated in a Public Health Laboratory in 2 years. Thirty-two were derived from healthy throats, 4 from healthy vaginae, and the remainder as follows: acutely ill cases (septicaemia, cellulitis, septic throat) 9, mild tonsillitis 33, soft-tissue suppuration 12, puerperal genital tract 12, chronic bronchitis 3. In the majority of cases the disease was mild. All strains gave a clear-cut serological reaction with Group C serum and all yielded a soluble haemolysin. Sixteen strains fermented trehalose but not sorbitol, thus resembling Evans's *Str. equisimilis;* of these 16, 4 failed to ferment human fibrin and so were possibly of animal origin. The 30 strains failing to ferment sorbitol or trehalose all lysed human fibrin and differed from *Str. equi.* in various ways.

R. E. O. Williams

47. **Penicillin in Treatment of Acute Puerperal Mastitis.**
By M. D. TAYLOR and S. WAY. *Brit. med. J.*, **2**, 731–732, November 16, 1946. 2 refs.

THE INFANT

48. **Rubella and Congenital Abnormalities.**
EDITORIAL REVIEW. *Brit. med. J.*, **2**, 778–779, November 23, 1946. 9 refs.

49. **Congenital Cardiac Defects Associated with Maternal Rubella.**
By L. P. WINTERBOTHAM. *Med. J. Aust.*, **2**, 16–19, July 6, 1946. 1 fig.

Some statistical indirect evidence is adduced in support of the thesis enunciated by the Australian ophthalmologist N. M. Gregg (*Trans. Ophthal. Soc. Aust.*, 1941, **3**, 35) and others that certain cases of congenital cataract, deafness, and cardiac and other defects occur apparently as a result of German measles attacking the mother during the first 4 months of her pregnancy. As rubella is not a notifiable disease reliable information concerning its epidemic prevalence is difficult to obtain. It is known, however, that in Queensland the 2 principal outbreaks of rubella in recent years occurred in 1937 and 1940. The author correlates with this fact: (1) a considerable increase in the number of cases of congenital deaf-mutism in 1938, as shown by the fact that no fewer than 48 new pupils enrolled in the Blind and Deaf School, Brisbane, in 1945, compared with an annual average admission of 7; (2) an increase in the number of deaf children born in 1940 now registering in the school; and (3) the fact that deaths from congenital heart disease in the year 1941 reached the highest figure so far recorded for Queensland. Similarly, in New South Wales, a thirty-fold increase in the number of children absent from school on account of rubella in 1940 as compared with 1939 is correlated with a large increase in admissions to the school for deaf children born in 1941, and with a greatly increased mortality rate from congenital heart disease in the same year. Similar correlations between epidemic prevalence of rubella and increases of deaf-mutism and of infantile cardiac mortality are presented for the states of Victoria, South Australia, and Western Australia. This evidence, as the author remarks, is not conclusive, but presents at least a remarkable coincidence.

A graph illustrates clearly for the State of Queensland the wave of increase in the number of children born deaf which occurred about every fifth year for the past 42 years. The increase for 1941 was high, and for 1938 was enormous, and there is evidence suggesting a correlation with rubella for these 2 years. For earlier years, in the absence of information on the incidence of rubella, the correlation can be by inference only. In view of the importance of the social and economic questions involved it is rightly suggested that further wide investigations should be undertaken. Information is required particularly about apparently healthy children whose mothers are believed to have suffered from rubella in early pregnancy. Thus, in Western Australia, rubella has been made a notifiable disease, and in Queensland a survey is to be undertaken of all school children born in 1941 to ascertain whether the mother had suffered from rubella during that pregnancy, and, if so, what effect it had had on the child.

H. Stanley Banks

50. **Maternal Disease as a Principle in the Epidemiology of Congenital Anomalies, with a Review of Rubella.**

By W. L. AYCOCK and T. H. INGALLS. *Amer. J. med. Sci.*, **212**, 366–379, September 1946. 5 figs., 44 refs.

51. **Congenital Cataract and Other Anomalies following Rubella in the Mother during Pregnancy.**

By J. T. PRENDERGAST. *Arch. Ophthalmol.*, **35**, 39–41, January 1946.

52. **Some Observations on Congenital Defects following Maternal Rubella.**

By N. McA. GREGG. *Bull. Postgrad. Comm. Med., Univ. Sydney*, **1**, 98–105, October 1945.

53. **The Miasm of Marasmus.**

ANNOTATION. *Brit. med. J.*, **2**, 497–498, October 5, 1946. 7 refs.

With an increased incidence of enteritis in the general population diarrhoea in mothers and babies has been observed in lying-in hospitals. A typical epidemic occurred in general and maternity wards of a 1,000-bed hospital in May 1945 and was described by Brown, Crawford, and Stent (*Brit. Med. J.*, 1945, **2**, 524). During a 15-week period 20 patients had diarrhoea on admission, and 91 persons, including 27 nurses and 25 babies, developed watery diarrhoea while in hospital. There was vomiting in 46 of the total 111 cases, and pyrexia in 32 of the 89 adults. Twenty-five adults had nausea. The outbreak was traced from 2 emergency cases admitted to a surgical ward, through a ward maid, a nurse, babies, mothers, and medical officers. There were no significant bacteriological findings. The disease, which was considered by local doctors to be a new one, was widespread among the adult population. No deaths had occurred. The epidemic was instructive because: (1) The maternity unit consisted of 66 beds and 66 cots in 3 adjacent wards, one of which escaped entirely. (2) All babies were breast-fed, yet often the mother only or the baby only was affected; when both were affected babies showed signs 4.4 days (on an average) earlier than mothers. (3) The outbreak terminated spontaneously without closure of the maternity unit. (4) The severity was not comparable to that of a previous epidemic of neonatal diarrhoea.

Since then, in some of the 1946 outbreaks of this watery diarrhoea in mothers and babies, an appreciable mortality among the babies has been reported—12 out of 77 affected babies in one outbreak. The characteristic orange-coloured stools of the "epidemic diarrhoea of the newborn" have not been described, nor has there been evidence of parenteral infection. Sulphonamides have been ineffective. Some of the babies seemed at first to respond to treatment, then collapsed and died rather suddenly. The diagnosis of "epidemic diarrhoea of the newborn" is difficult to make in the initial cases of an outbreak, and it is wise to treat every infant with diarrhoea or, in fact, sudden loss of weight, as potentially infectious. The term "diarrhoea of the newborn" has in itself little meaning; it describes a clinical entity with a very varied aetiology. Our concept of the causes is not appreciably removed from the "miasm" stage, and careful records with full descriptions of all the clinical and epidemiological features of an outbreak would be of the greatest value in elucidating the problem.

Mary J. Wilmers

54. **Diarrhoea and Enteritis amongst Infants in the London Area, 1930–38.**

By G. PAYLING WRIGHT and H. PAYLING WRIGHT. *J. Hyg., Camb.*, **44**, 480–490, September 1946. 19 refs.

55. **Studies of Maternal and Infantile Blood Factor Relationships.**

By L. M. BRYCE, R. JAKOBOWICZ, and N. McARTHUR. *Med. J. Austr.*, **2**, 217–224, August 17, 1946. 2 figs., 18 refs.

It is now fully established and widely known that when an Rh-negative woman becomes pregnant with an Rh-positive foetus she sometimes forms anti-Rh anti-bodies and passes them back through the placenta, with resulting damage to the foetus. Nevertheless, knowledge is still incomplete about the frequency with which this occurs, the factors determining its occurrence in one case rather than another, and the role of antigens other than Rh in the process. The present paper records the result of a survey of 2,230 women whose blood was examined during pregnancy. This number has been split up into different groups because some of the women were not followed to term or the blood of their infants was not tested. The most important group analysed was of 850 women who were tested at intervals during pregnancy and followed to term, and whose infants were also tested. In these 850 cases the incidence of damage to the foetus, here defined as stillbirth, prematurity, icterus gravis, mild jaundice, and anaemia, was twice as high (28.6 per cent) in those cases in which the

mother was Rh-negative and the infant Rh-positive as it was in the remaining cases (14.5 per cent). Icterus gravis neonatorum was diagnosed in 10 of the 850 cases; in 4 of these 10 cases the mother was Rh-positive, but there was incompatibility between mother and foetus with regard to the ABO groups. [The authors' assumption that in these cases immunization of the mother to A or B was responsible cannot be accepted unreservedly; there may, for instance, have been Rh sub-group differences which would not have been detected by the method employed, and the test for blocking antibodies (Wiener's) may have failed to detect sensitization to Rh in some of these cases.] In the series as a whole, ABO incompatibility did not cause a significant incidence of damage to the foetus, though the authors believe that it may occasionally cause icterus gravis and, more frequently, a mild form of haemolytic disease, manifested as " late anaemia." Seven of 9 cases of anaemia of the newborn in this series were associated with ABO incompatibility between mother and foetus.

Titration of anti-A and anti-B agglutinins in the mother's plasma showed no changes early in pregnancy, but in over half the cases in which there was incompatibility between the foetal cells and the mother's plasma there was an immune response after delivery. This stimulation only occurred when the infant was a secretor, and then not always. Because of " the widespread popular belief that there is a higher incidence of miscarriages, stillbirths, neonatal deaths, and other obstetric accidents among Rh-negative than among Rh-positive women," two series of women were questioned as to their past history—namely, a group of 200 blood donors (100 Rh-negative and 100 Rh-positive) and a series of 1,379 women, unselected with regard to Rh type, attending an ante-natal clinic. Statistical analysis revealed " no close correlation between such accidents, taken collectively, and the Rh-negative state," although " there was among the Rh-negative women a significantly higher incidence of prematurity, stillbirths, and icterus gravis neonatorum."

[The inclusion of stillbirths among the " obstetric accidents " to which the Rh-negative woman is not especially liable and also among the conditions to which her foetus *is* especially liable makes this statement confusing. The point seems to be that only some stillbirths are due to damage of the foetus by agglutinins, and that very few miscarriages are caused in this way. Thus, if miscarriages and stillbirths from all causes are grouped together it will be difficult, except in a very large series, to show that incompatible agglutinins play any part in their aetiology.]

P. L. Mollison

56. **Recent Developments in the Knowledge of the Rh-Hr Blood Types: Tests for Rh Sensitization.**
By A. S. WIENER. *Amer. J. clin. Path.*, **16**, 477–497, August 1946. 2 figs., 76 refs.

57. **The Blood Group Rh. I. A Review of the Antigenic Structure and Serological Reactions of the Rh Subtypes. II. Clinical Applications in Transfusion Therapy and in Haemolytic Disease of the Newborn.**
By D. F. CAPPELL. *Brit. med. J.*, 2, 601–605, October 26, 1946; 641–647, November 2, 1946. 62 refs.

58. **Jaundice in the Newborn Infant.**
By G. W. SALMON. *Tex. St. J. Med.*, 42, 366–371, October 1946. 6 figs., 11 refs.

59. **Icterus Gravis Neonatorum: End-results of Treatment by Blood Transfusion.**
By H. THIRD. *Lancet*, 2, 635–636, November 2, 1946. 6 refs.

See also Nos. 11, 15, 21.

GYNAECOLOGY

Menstrual disorders.

60. **Studies in Nicotinic Acid.**
By R. W. HAWKER. *Med. J. Aust.*, **1**, 872–876, June 22, 1946.

The history and physiology of nicotinic acid are briefly described. In 1926 it was found that the thermostable portion of the vitamin B complex possessed pellagra-preventive properties; subsequently it was demonstrated that the black tongue of dogs was analogous to pellagra. In 1937 nicotinic acid amide was isolated from liver concentrates; it was found to cure black tongue in dogs, and later pellagra in man. The chief dietary sources are meat, fish, wheat germ, unpolished rice, and yeast. Chemically, nicotinic acid is a pyridine β-carboxylic acid, and the amide forms the prosthetic group of both co-enzymes I and II. Vasodilatation is produced by nicotinic acid and its salts, but not by the amide or diethylamide (nikethamide or " coramine ").

The first section of the paper discusses the influence of nicotinic acid in stimulating the growth and development of primordial follicles in immature virgin guinea-pigs. The experiment lasted 17 days, and at the end of this period the ovaries of the animals treated with oral nicotinic acid showed an increase in weight of 22 per cent over the controls, while the pituitary glands showed a decrease in weight of 20 per cent as compared with the controls. The increase in weight in the treated ovaries was due to the rapid proliferation and ripening of many primordial follicles. The author admits that, as only 4 animals were used, the experiment is inconclusive.

The second section discusses the effects of nicotinic acid in amenorrhoea, hypomenorrhoea, and dysmenorrhoea. Two cases of primary amenorrhoea of ovarian type are described, both responding successfully to nicotinic acid in a dosage of 50 mg. thrice daily. A third case—of a married woman with a small fibromuscular uterus—failed to respond to treatment. Hypomenorrhoea is attributed to insufficient endometrial change, resulting from either insufficient ovarian hormone stimulation or local uterine abnormality, due to defective ovaries, hypopituitarism, or hypothyroidism. Eleven cases are described, all of which were treated with nicotinic acid; success was achieved in 9 with 2 failures. Dysmenorrhoea is divided into two categories: (1) primary, where the cause is not known, and (2) secondary to some pelvic abnormality. Fifteen patients suffering from primary dysmenorrhoea were selected for treatment. Oestrone, 1 mg. thrice daily, had a dubious effect, nicotinic acid, 50 mg. thrice daily, a delayed effect, while the combination of the two drugs was highly satisfactory.

The conclusions to be drawn from this study appear to be that hypofunction of the ovaries will respond to nicotinic acid but it is not possible to say whether the drug acts directly upon the epithelial elements of the ovary, whether it stimulates the immature or under-functioning primordial follicles through the anterior lobe of the pituitary gland, or whether its influence is through the autonomic nervous system. Stress is laid on the rapid weight loss experienced by obese subjects while receiving nicotinic acid and on the fact that when oestrone and nicotinic acid are combined their function is enhanced.

Geoffrey McComas

61. **Ovarian Haemorrhage.** (Les hémorragies ovariennes non gravidiques.)
By P. Mocquot and R. Musset. *Gynéc. Obstét.*, **45**, 337–358, 1946. 32 refs.

62. **Leucorrhea. A Diagnostic Aid.**
By D. Lazarus and E. E. Lazarus. *Med. Rec., N.Y.*, **159**, 672–674, November 1946.

See also Nos. 5, 19.

Sterility.

63. **Infertility.**
Editorial Review. *Brit. med. J.*, **2**, 618–619, October 26, 1946. 6 refs.

64. **Childlessness and the Small Family: a Fertility Survey in Luton.**
By R. M. Titmuss and F. Grundy. *Lancet*, **2**, 687–690, November 9, 1946. 2 refs.

65. **An Analysis of 257 Cases of Sterility.**
By S. G. Winson. *Amer. J. Obstet. Gynec.*, **52**, 631–635, October 1946. 6 refs.

66. **A Mucin-Splitting Enzyme (Hyaluronidase) in Normal and Pathological Semen.** (Uber ein mucinspaltendes Ferment (Hyaluronidase) in normalen und pathologischen menschlichen Sperma. Ein Beitrag zur Frage der männlichen Fertilitätsstörungen.)
By E. Eichenberger. *Gynaecologia*, **121**, 288–329, May–June 1946. 6 figs., 114 refs.

Within recent years more attention has been paid to the male factor in sterile marriages. It has been shown that for fertility the number of spermatozoa in the ejaculate must be of the order of 60,000,000 per ml. or more. Spallanzani was the first to point out the importance of this quantitative relation between the sperms and the ovum. Gleichen-Russworm in 1778 was the first to publish systematic sperm analysis, and in 1853 Gosselin showed the relation between gonorrhoea and aspermia. Winter in 1921 summarized the relation of azoospermia to infertility with figures gained from 4 sources, and found 25 to 33 per cent with this abnormality present. Meaker had no cases of fertility with sperm counts of under 60,000,000 per ml., and Walker only 4 out of 294 such patients.

This finding may be related to a mucin-splitting ferment which is important in the fusion of the sperm and ovum. Duran-Reynals in 1928, McClean in 1930, and Hoffman with Duran-Reynals in 1931 demonstrated an aqueous extract from the testes or semen which contained a factor increasing tissue permeability. This was termed a spreading or diffusion factor. In 1939 Chain and Duthie showed the

factor to work by mucolytic action producing an alteration in viscosity due to a ferment action. The ferment has been termed hyaluronidase. To demonstrate its action a basis is made from mucin tissue of synovia, cornea, or umbilical cord. This is prepared by cleansing the material, extracting any blood with acetic acid, which in turn is removed by alcohol and later water of *p*H 7.0. The mucin is then precipitated with acetic acidulated alcohol. Finally it is dried in a vacuum. The action tends to be specific to mucins obtained from mesothelial tissues—e.g., there is no reaction to salivary or bronchial secretions.

The biological importance was pointed out by Kurzrok and Miller in 1928, who showed that the semen dissolved the cervical mucus plug. The properties of thermolability, *p*H constancy, etc., favour a ferment action. The action can be nullified by pus in the secretion, hence sterility may result. Kurzrok and Miller also suggested the possibility of a lytic substance which loosens the cells of the corona radiata round the ovum. This was demonstrated experimentally in rats by McClean and Rowlands in 1942 (*Nature*, **150**, 627).

The author set out to demonstrate the presence of hyaluronidase in human semen, and to determine its relation to fertility. He has found an enzyme whose qualities are akin to those of hyaluronidase. In general there is a parallel between the number of sperms in the ejaculate and the enzyme content of the specimen. If there are no sperms there is no hyaluronidase. The method used was viscometric and the substrate was obtained from umbilical cord by McClean's technique.

With this article there is an excellent bibliography of the subject.

Kenneth Bowes

See also No. 10.

Infections of the Reproductive Organs.

67. **Infection of the Urinary Tract in the Female due to *Trichomonas vaginalis*.**

By B. Williams. *Brit. J. Urol.*, **18**, 63–65, June 1946. 3 refs.

The author believes that *Trichomonas vaginalis* is a common cause of urinary tract infection in young females, and describes 14 cases with urgency, frequency, and scalding on micturition, where *Trichomonas vaginalis* was found in the vagina. In several cases there were rigors, pain in the loins, and temperature up to 103°F. (39.4°C.). In only 1 case were a few active parasites found in a catheter specimen of urine. The urine usually contained many pus cells together with staphylococci or *E. coli* on culture. [The author has not brought forward any evidence, other than in 1 case, to show that the infection was not due to the presence of staphylococci or *E. coli* in the urine.] He considers that *Trichomonas vaginalis* was responsible for the urinary infection in view of its presence in the vagina or vulva. The urinary symptoms usually subsided quickly with rest, fluids, and alkalis, and, in a few cases, after administration of sulphanilamide or sulphathiazole.

The statement is made that it is probable that *Trichomonas vaginalis* is a frequent and common cause of urinary infection in the young female.

A. W. Badenoch

68. **A New Method of Treatment for Vaginitis and Cervicitis.**

By S. L. Siegler. *Amer. J. Obstet. Gynec.*, **52**, 1–13, July 1946. 6 figs., 24 refs.

Recent observations have shown the importance of the relationship between vaginal *p*H and vaginal flora. Jellies, tablets, and powders buffered to *p*H readings approximating to that normally found in the vagina have therefore been introduced. The ideal vaginal medicament should be easy to apply by the physician, buffered effectively to promote correct acidity and growth of Döderlein's bacilli, antibacterial, of a physical consistency to ensure intimate and prolonged contact with vaginal and cervical mucosa, non-toxic and effective against both bacterial and protozoal infections. The author believes that these conditions are best fulfilled by an acid jelly containing sulphathiazole. The base is polyethylene glycol and a single, disposable paper container is used. Criteria of cure are: complete relief of symptoms, return to normal *p*H, and negative smears at intervals during three months following the end of treatment.

Of 230 cases of vaginitis from various causes 83 per cent were cured. In 2 cases a rash developed attributed to sulphathiazole. Of 24 cases of trichomonas infection 75 per cent were cured with acid jelly alone, without sulphathiazole. The rest were subsequently cured by changing to sulphathiazole. Gentian violet acid jelly was effective in 28 cases of monilia vaginitis, but failed in 2 cases where sul-

phathiazole acid jelly had also failed. Iodine in the acid jelly base (1 per cent) was effective in 6 cases of trichomonas, but produced a chemical burn in 2 cases and was therefore discontinued.

Sulphathiazole acid jelly was used in 152 cases of cervicitis, either alone or after cauterization. Good results were obtained, there was no offensive odour or foul discharge and the vaginal *p*H was found to be normal at the end of treatment. There was a marked reduction in healing time. Sulphathiazole was shown to be important in these cases and healing was definitely prolonged in cases where acid jelly alone was used. Sulphathiazole-polyethylene acid jelly was also found to control vaginal infections after surgery by the vaginal route.

The chief risk appears to be that of sensitivity to sulphathiazole, but the method has many advantages, including ease of application, which means ready co-operation on the part of the patient. The disposable paper container is especially advantageous in this respect.

Josephine Barnes

69. **Cervical Erosion.**
By J. D. JOUBERT. *S. Afr. med. J.*, **20**, 632–633, October 26, 1946.

70. **Does Metritis of Endocrine or Dietary Deficiency Origin Exist?** (Existe-t-il des métrites d'origine hormonale ou par carence?)
By J. BRET and J. BALMARY. *Rev. franç. Gynéc.*, **41**, 309–318, October 1946.

The authors report on a series of cases of intractable cervicitis and vaginitis which did not respond to any of the orthodox treatments. Not even temporary improvement occurred from injections, local applications, cauterization, or diathermy, in the endocervicitis, cervical erosion, or the abundant purulent vaginal discharge of these patients. There was no evidence of infection by the gonococcus or the *Trichomonas vaginalis*, and the only positive finding was a high cervical and vaginal *p*H, varying from 6 to 8 (the normal average being 4.6). The ages of the 10 patients reported on varied from 10 to 54 years. Locally all had an inflammation of the cervix, with or without an accompanying vaginitis, the *p*H being invariably on the alkaline side of normal. Another finding common to all patients was hypomenorrhoea or amenorrhoea, suggestive of ovarian hypofunction. On investigation, all the patients were found to have been under-nourished for some considerable time, fats and proteins of animal origin especially being lacking in their diets. As ovarian hormones are essential for the proper nutrition of cervical and vaginal mucosae, the authors suggest as a hypothesis that the lack of fats has caused a diminished production of cholesterol in the body, this in turn producing an insufficient amount of sexual hormones, which are apparently synthesized by the body from cholesterol. As additional evidence of this possible explanation, the authors bring forward the observations by Russian medical research workers on women and girls who died of starvation; Graafian follicles were entirely absent from the ovaries of little girls and there were no fully-developed follicles in the ovaries of adult women.

The authors also mention a recent experiment conducted in France, proving that the weight of the pituitary body is diminished in rats kept on a starvation diet, and the finding that there is a diminution in the number of eosinophil cells in the pituitary glands of grossly under-nourished human beings. The authors' treatment of the cases under review consisted of the following: (1) Local—(*a*) acid vaginal douches, (*b*) application of an acid cream (*p*H 4.5) to combat the pruritis usually co-existing with the profuse vaginal discharge. (2) General—(*a*) diet rich in fats and meat, (*b*) calcium by injection, (*c*) administration of vitamin D and irradiation with ultra-violet light, (*d*) administration of ascorbic acid and fresh fruit, and (*e*) phosphoric acid administration. In addition, the patients in whom an ovarian insufficiency was suspected received anterior pituitary extract, oestradiol benzoate, and stilboestrol. Finally, when the cervical erosion did not heal spontaneously after the vaginitis had disappeared, local treatment in the shape of sulphonamides or diathermy was used. Details of administration of drugs are not given.

N. N. Tereshchenko

71. **Latent Tuberculosis of the Female Genital Organs. Its Frequency and Importance as a Cause of Sterility in Women.** (La tuberculose latente des organes génitaux feminins, sa fréquence et son importance comme cause de stérilité chez la femme.)
By I. HALBRECHT. *Schweiz. med. Wschr.*, **76**, 708–709, August 3, 1946. 3 refs.

The author gives the results of investigation of 820 sterile women, all of whom were subjected to diagnostic curettage 2 to 3 days before a menstrual

period to determine whether ovulation was occurring. Forty-five cases (5.5 per cent) showed histological evidence of tuberculous endometritis. This is in contrast to 5 cases out of a series of 5,516 investigated by Dominguez. In all but 2 cases the normal signs of a secretory phase were found. Forty-three were cases of primary sterility. A further series of 54 sterile women, in whom partial or total occlusion of the tubes had previously been demonstrated, was subjected to curettage, and 18 (33.3 per cent) were found to have tuberculous endometritis. All were free from symptoms of tuberculosis and few had possible tuberculous antecedents. The author concludes that latent genital tuberculosis occurs relatively frequently in women, and particularly in sterile women, that it nearly always leads to eventual blockage of the tubes, that salpingostomy in such cases would be useless and treatment should be rigidly conservative.

[These observations were made on Palestine Jewesses.]

S. S. B. Gilder

See also No. 19.

New growths of the reproductive organs.

72. **Prevention and Treatment of Carcinoma of the Vulva.**

By B. P. Watson and S. B. Gusberg. *Amer. J. Obstet. Gynec.*, **52**, 179–190, August 1946. 3 figs., 22 refs.

In this paper Watson and Gusberg discuss the prevention and treatment of carcinoma of the vulva, and refer to 30 cases which they have treated. They point out that carcinoma of the vulva is an uncommon disease and occurs at an age when the expectancy of life is not long, and therefore some latitude in the treatment of individual cases is required. They stress the importance of prevention by biopsy excision of any suspicious lesion of the vulva, and excision of the vulva for all cases of leucoplakia causing irritation. In their series of 30 cases the average age was 59 years, the youngest patient being 37. The long period for which symptoms were present before treatment started is noted. This was on an average: pruritus 8 years, lump or growth 1.25 years, and pain 0.69 years. The first symptom was a lump in 18 cases, pruritus in 16 cases, and pain in 6 cases. In 5 of the cases it was not possible to say if the growth was primarily in the vulva or not; 17 cases survived for 2 years, and the cases traced for longer than this showed that patients dying of recurrence did so within 2 years.

Treatment varied from total vulvectomy with dissection of the glands to lesser surgical procedures with or without irradiation or irradiation alone. The treatment was essentially surgical, irradiation being used for palliation only. (In basal-celled or border-line cases a local wide excision is adequate, and is regarded as the best method of biopsy.) Complete vulvectomy with dissection of the glands of both groins is to be preferred. A one-stage operation is used, and the glands are dissected first. The external ring is incised and fatty tissue removed from the canal. The upper end of Scarpa's triangle is cleaned, but the deep femoral and retroperitoneal glands are not removed. Involvement of the retroperitoneal glands appears to depend on extension of the growth to the vagina, and is well seen in some of the fatal cases. If the vagina is involved all the deep pelvic glands are rapidly involved. Cloquet's gland is removed by most operators, but omission of this stage has not affected the results in the present series. In the discussion which followed, all the speakers agreed that the treatment of carcinoma of the vulva was essentially surgical, and that the 5-year cure rate was in the region of 25 per cent.

L. W. Lauste

73. **Malignancy of the Genitourinary Tract in Children. Report of a Case of Sarcoma of the Vulva.**

By A. C. Service and R. C. Derbyshire. *J. Pediat.*, **29**, 228–232, August 1946. 3 figs., 11 refs.

74. **Sarcoma of the Vulva.**

By W. K. Diehl and J. S. Haught. *Amer. J. Obstet. Gynec.*, **52**, 302–310, August 1946. 6 figs., 8 refs.

The literature relating to sarcoma of the vagina is briefly reviewed by the authors. Two cases are described occurring at the University of Maryland amongst 8,589 gynaecological admissions. The first case, a 21-month-old white child, was of the well-known botryoid type. Symptoms of bleeding and vaginal discharge had been present for 3 months before advice was sought. Small polypoid masses were found growing from the right lateral vaginal wall. Microscopically the tissue removed was seen to be myxosarcomatous. The growth was removed, and two 50 mg. radium plaques were applied to the base for 10 hours. Two months later multiple recurrences were present, and radiotherapy totalling

2,072 r units was given. Five months later death occurred. Necropsy showed extensive local spread involving all the pelvic organs. There were no distant metastases. In the adult, sarcoma of the vagina is rarely of the botryoid type but is seen either as a mucosal or parietal (submucosal) type. The second case presented is of the adult type in a negress of 40 years. The complaint was of vaginal soreness and slight bleeding on trauma. A walnut-sized tumour covered with a greyish-white exudate was seen half-way up the right antero-lateral vaginal wall. The growth was removed to the level of the surrounding vagina, and 100 mg. radium screened with the equivalent of 3 mm. lead was applied to the surface for 30 hours. Since treatment there has been a gradual regression of the growth without further extension. Commenting on the treatment of vaginal sarcoma, the authors suggest local removal of the growth, possibly by electro-surgery, and application of radium in suitable dosage to the base thereby exposed. Deep *x*-ray therapy is a valuable adjunct. The prognosis in the infantile botryoid type and in the adult forms is uniformly bad on account of the rapidity of extension and tendency to local recurrence.

B. Rickford

75. **Cyst of Skene's Gland. (Kyste de la glande de Skene.)**

By J. LEGAULT. *Un. méd. Can.*, **75**, 777–779, July 1946. 1 fig.

The author describes a case of frequency of micturition with dysuria due to a cyst of the gland of Skene in the urethra of a woman of 36. He discusses the differential diagnosis from urethral polyp, urethral prolapse, diverticulum, calculus, and herniation into the urethra of a cystic dilatation of the lower end of the ureter. Treatment by removal of the cyst is extremely simple and satisfactory.

S. S. B. Gilder

76. **Endometriosis: a Surgical Problem.**

By D. MACLEOD. *Brit. J. Surg.*, **34**, 109–116, October 1946. 10 figs., 57 refs.

77. **Endometriosis in Youth.**

By J. FALLON. *J. Amer. med. Ass.*, **131**, 1405–1406, August 24, 1946. 16 refs.

The author reports 9 (4 per cent) of a series of 225 cases of endometriosis as occurring under 20 years of age. This is surprisingly high, as previous reports have always stressed the rarity of this condition in youth. It is suggested that this rarity is only apparent, and that the disease should be considered in the differential diagnosis of abdominal pain as soon as menstruation has been established. There is some evidence that endometriosis tends to develop when menstruation has been uninterrupted by pregnancy for 5 years, so that it might be reasonably looked for at 17 to 19 years. The 9 cases reported here were all verified histologically; if other cases were included in which there was only macroscopic evidence the percentage would have been doubled. From the clinical aspect the cardinal symptom, apart from pain, is increasing dysmenorrhoea, and the discovery of the lesion depends on using an adequate mid-line incision for pelvic exploration when operating for doubtful appendicitis.

A. D. Le Vay

78. **Endometriosis of the Small Intestine.** (Endométriose du gréle.)

L. MICHON and C. OLIVIER. *Presse méd.*, **54**, 534–538, August 17, 1946.

The authors describe 2 cases of endometriosis of the small intestine in which the only symptoms were those of intestinal obstruction and the diagnosis was made by the pathologist.

The first patient, a woman aged 33, had recurrent pains in the right iliac fossa over a period of 6 months. Periods were painless and regular. Laparotomy, performed with a view to appendicectomy, revealed a hard mass in the ileum 4 in. (10 cm.) above the ileocaecal valve with peritoneal adhesions around it. End-to-end anastomosis was performed. The patient died on the sixth day of pulmonary embolism. Histologically, endometriosis was found in the longitudinal muscle layer.

The second patient, a woman aged 41, who had suffered from blood-stained diarrhoea for 15 years, was admitted with acute intestinal obstruction. Her emaciation and the absence of other physical signs pointed to a tentative diagnosis of tuberculosis. At laparotomy a tumour some inches above the ileocaecal valve was found. Ileostomy was performed. A later X-ray examination showed a stricture at the rectosigmoid junction. After 3 weeks a second laparotomy revealed easily-separated adhesions round the rectum, with normal ovaries. The ileal tumour was resected and the

patient made an uneventful recovery. Histologically the specimen showed typical endometriosis. In neither case had there been any menstrual disturbances.

S. S. B. Gilder

79. **Endometriosis of the Recto-sigmoid Junction Simulating a Neoplasm.** (Endométriose de la jonction recto-sigmoidienne ayant simulé un néoplasme.)

By H. GUIAS, J. MINET, and B. DUPERRAT. *Paris méd.*, **36**, 430–432, October 5, 1946. 1 fig.

The authors record a case of endometriosis of the recto-sigmoid region simulating carcinoma. Endometriosis of the pelvic colon and recto-sigmoid region is rarely met with, though localization in the pouch of Douglas is fairly common. Diagnosis of intestinal and rectal endometriosis is difficult but important, because if the condition is not recognized the patient may be subjected to unnecessary surgical treatment.

Cuthbert E. Dukes

80. **Differential Diagnosis of Lutein Cysts and Ectopic Pregnancy.** (Quiste luteinico. Su diagnostico diferencial con el embarazo tubario.)

By R. L. MASCIOTTRA and E. P. BAGNATI. *Rev. méd.-quir. Pat. fem.*, **25**, 164–172, May 1946. 12 refs.

The differential diagnosis of lutein cyst is often difficult, and many cases are wrongly diagnosed as ectopic pregnancy. Certain laboratory investigations may help to solve the diagnostic problem, as in the case recorded. A patient aged 29 from whom bilateral cysts of the ovaries had been removed 2 years previously had persistent amenorrhoea. Examination revealed pigmentation of the nipples and engorgement of the breasts with some secretion. The uterus was slightly enlarged, with a tender, cystic swelling to the left of the uterus. A Friedman test was negative. Endometrial biopsy showed endometrium of a secretory type, corresponding to the fourth week of the cycle. At laparotomy a lutein cyst of the left ovary was removed. Uterine haemorrhage occurred 24 hours after operation, and normal menstruation 5 weeks later.

Signs of early pregnancy with a swelling in the fornix, as in this case, suggest a diagnosis of ectopic gestation, but these signs also occur with lutein cyst. Differential diagnosis depends on the following. (1) *Examination of endometrium.*—In lutein cyst, the secretory phase is the rule, but a pseudo-decidual reaction may occur in cases of long-continued action of a corpus luteum on the endometrium, and may lead to confusion with ectopic gestation. (2) *Biological tests for pregnancy.*—These are not always reliable; a negative test is usual with lutein cyst, but sometimes occurs in ectopic pregnancy; a positive test, on the other hand, has been reported in cases of lutein cyst, possibly due to excessive production of pituitary gonadotrophin, because there is diminution in the amount of oestrogen produced and thus enhanced anterior pituitary secretion. (3) *Pregnandiol assay.* This should be carried out in cases where there is doubt; excretion is increased both in ectopic pregnancy and in lutein cyst, but in the latter condition, the increase is much greater. (4) *Exploratory colpotomy.*—The operation is the final test in cases where the diagnosis is in doubt. It is much less traumatizing than laparotomy, and permits thorough exploration of tubes and ovaries. If the diagnosis of lutein cyst is confirmed, nothing further is required. In cases of ectopic pregnancy, if the gynaecologist is accustomed to the technique of vaginal operations, it may be possible to complete the operation by this route. In difficult cases laparotomy is undertaken, but with the diagnosis established.

[This is a sound paper on a subject which often leads to error. Many gynaecologists would not operate for ectopic pregnancy if the biological test was negative and there was no pain; such cases often subside and do not need operation. Posterior colpotomy has never found much favour in Britain, though some gynaecologists, as an alternative, explore the pouch of Douglas with a needle in cases of ectopic pregnancy. Where the operator is familiar with the technique, posterior colpotomy is often a useful procedure.]

Josephine Barnes

81. **Chorionic-Gonadotrophin and Ovarian Tumours.** (Gonadotrophines et tumeurs ovariennes. Gonadotrophinurie dans un cas princeps de dysembryome polyembryonique et chorio-épithéliomateux avec puberté précoce incomplète.)

By M. SORBA. *Gynaecologia*, **122**, 53–67, July–August 1946. 2 figs., 56 refs.

The author reports the detailed findings in a case of malignant ovarian teratoma in a child aged 2 years, claiming this to be the youngest case reported in the literature of a teratoma containing

chorionic epithelial tissue. The symptoms were abdominal pain and increasing size of the abdomen for some months. There had been some white mucoid discharge vaginally but no periods. Though the breasts were palpably enlarged there was no growth of pubic hair. Abdominal examination showed a large tumour reaching to the umbilicus which, on laparotomy, proved to be an ovarian tumour arising on the right side with spread to the right iliac and aortic glands. There was a small similar tumour in the left ovary. The uterus was enlarged. The right ovary was removed and the tumour in the left was shelled out. The tumour weighed 1,420 g. and microscopical examination showed multiple tissues which included chorionic epithelium.

Having previously been interested in hormonic assays in cases of testicular tumour and having been struck by the easier interpretation of similar assays in the female before puberty, the author followed this patient up by gonadotrophic estimations. Two days after operation the Friedman test was positive in 30 and 50 ml. and negative in 5 and 10 ml. of urine. The reaction became negative within 3 months of operation. The child died from metastases 8 months later.

Such teratomata are rare, Miller (Henke-Lubarsch: *Handbuch der pathologischen Anatomie*, 1937, Teil VII, Bd. 3) recording only 20. The author could find 9 below the age of puberty which have been reported. He also reviews the literature on gonadotrophic excretion in cases of ovarian tumours and comments on the variation in findings of different authorities.

R. K. Bowes

82. **The Clinical Treatment of Ovarian Carcinomata.** (Beitrag zur Klinik und Therapie der Ovarialcarcinome.)

By K. Abt. *Gynaecologia*, **122**, 75–109, July–August, 1946. 1 fig.

Two 10-year series of cases of ovarian carcinoma are reviewed here, one series for 1921–33 at the women's diseases clinic at Zürich, the other being for 1928–38 at a similar clinic at Basle. There were 105 cases at Basle out of 13,637 gynaecological patients, of whom 768 had genital carcinoma. At Zürich the corresponding figures were 79 cases out of 10,931 admissions and 658 cancer cases. The proportion of malignant to benign ovarian neoplasms was 18.7 per cent at Basle and 18.8 per cent at Zürich. The greatest incidence relative to 5-year age periods was between 35 and 65, this span having 82 per cent of the cases. There appeared to be no particular relation to previous parity. Of patients with primary carcinoma or cancer developing in a simple tumour 34 per cent were sterile. Only 23 per cent of patients with secondary ovarian carcinoma were sterile. Between 20 per cent and 23 per cent of the patients had a familial history of cancer (cf., 16 per cent in non-cancerous affections of the same age period 40–60 years); 31 per cent of the tumours were primary carcinomata, 57 per cent appeared to have developed in previously existing benign tumours, and 12 per cent were metastatic in origin. Most histological types occurred in the primary series, the previous benign lesions being cystadenoma 57, dermoid 2, and teratoma 1. The author refers to the well-known difficulty of classification of some of the papilliferous growths. Of the metastatic tumours 9 had their source in the stomach, 2 in the breast, and 2 in the gall-bladder.

Analysis of the cases not of metastatic origin showed clinically 3 groups. Group 1 contained those in which the growth macroscopically was confined to the ovary itself. In Group 2, the growth had extended beyond the ovary but complete removal was possible at operation, while in Group 3 the extension of the growth made complete removal impossible. 67–77 per cent of patients had growths at operation of group 2 or 3—i.e., the prognosis is unfavourable in this high proportion of patients. The right ovary was the site of tumour in 33.3 per cent, the left in 27.6 per cent and both ovaries in 23.8 per cent. Most were large tumours (47.6 per cent) and 77 per cent had metastatic spread to the peritoneum, pouch of Douglas and pleura. Symptomatically 60 per cent of patients gave a history shorter than 3 months, and about the same proportion gave a history of abdominal pain as the main symptom. Other symptoms were constipation and bowel disorders (40 per cent), urinary symptoms (17 per cent), and genital bleeding (28.6 per cent). The bleeding from the genital tract was not always due to the carcinoma; 6 had metastatic deposits in the uterus and vagina, and other lesions found were fibroids and polyps. The author was not as impressed as some have been by the association of bleeding with ovarian carcinoma and this is reasonable as many tumours do not contain endocrines. No feminizing symptoms occurred. In addition,

ascites was present in 63 per cent and pleural fluid in 2 per cent. The blood sedimentation rate was not altered sufficiently frequently to consider it of value in diagnosis. Loss of weight was a very significant sign.

Kenneth Bowes

Operations.

83. **Post-Operative Activity and Resumption of Normal Movement. Their Influence on Embolism and Thrombosis.**

By G. FITZGIBBON. *Brit. med. J.*, 2, 413–416, September 21, 1946. 6 figs., 6 refs.

The recent tendency to advocate an increase in activity after operation as a prophylactic against complications such as embolus has led the author to develop a method of post-operative treatment which aims at the restoration of natural movements, the adoption of restful positions, and thus the restoration of the activity of the trunk muscles.

The abdominal wound, including skin, is closed with continuous sutures of plain catgut. No tension sutures are inserted. Two strips of 1-in. (2.5 cm.) strapping are laid across the incision, and 3 or 4 layers of gauze cover the line of suture. The whole is covered by a sheet of plaster 5 × 7 in. (12.5 × 17.5 cm.), held in place by a band of 3-in. (7.5 cm.) strapping along the top. The dressing is not moved until the fifth to seventh morning. When the abdomen is drained additional gauze is placed over the tube and kept in place with strapping and a " T " bandage. After vaginal operations no tampon or drain is inserted; the vulva is covered by a pad. Tension sutures and clips are avoided as they cause pain. A binder is used for 12 hours to prevent the strapping being displaced. The patient is put on the trolley in the same position as she will be in bed—in complete flexion on her side. She is lifted into bed lying on one side, so that the body tends to fall into a prone position. The head is flexed forward, resting on a pillow, with the mouth slightly dependent. When deep anaesthesia passes off the patient will tend to adopt a twisted position, resulting in painful stiff muscles—a potent factor in the subsequent disinclination to move. A nurse should assist her into the opposite flexed position. This proceeding may have to be repeated until she is sufficiently awake.

On the first morning, for short periods, the patient sits up in bed in a comfortable relaxed position, moves up on her pillows, or props herself on her elbows. On the second day she sits up in bed, so as to allow her whole spine to flex, her shoulders to drop, and to sit easily balanced for a few minutes. Once complete flexion of the spine has been obtained the guarding of the muscles will pass off. From the third day the patient freely moves in bed, and gets out to urinate and defaecate. At intervals through the fourth or fifth day she sits up for half an hour. During the second week patients walk about the ward. They go to the lavatory and have baths from the ninth or tenth day. The essence of management in early convalescence is to obtain active muscle exercise of the whole body all through the day, but never to continue beyond the least feeling of fatigue.

Post-operative sedatives should not be given until there is definite pain in the wound. They may be repeated through the first 2 or 3 nights, but omitted in the daytime. In 7 to 9 hours, and at regular inservals afterwards, the patient is asked to pass urine on the bed-pan or, preferably, out of bed. If this fails, a catheter is passed. One ounce (28.4 ml.) of liquid paraffin is given on the second and third days, and the patient tries to have a bowel action on the night-chair after breakfast each day. If necessary a small enema or a mild laxative may be given.

In the past 25 years, among over 700 hysterectomies, the author has never had a death from, nor even symptoms suggestive of, pulmonary embolus after operation. In the only 3 postmortem specimens he recollects, the clot had formed in the pulmonary artery, and the author bases his treatment on the belief that this is what occurs in practically all fatal cases. Treatment is by prevention, and is effected by promoting circulation by active movement.

The treatment of venous thrombosis is based on the same views. Thrombophlebitis being due to infection, treatment is directed towards the cause. When the acute stage is passed movement should be encouraged. Earlier recovery is promoted by allowing the patient to get up and use the limb as soon as the primary pain has passed. Thrombosed veins are unimportant as there is no tendency to embolus. The limb is ignored beyond placing a cage over it, or putting a pad over a painful surface vein.

There are absolutely no contra-indications to

active movement. The one essential demanded in all operations is complete haemostasis.

W. R. Forrester Wood

81. **The Manchester Operation, with Special Reference to Parturition and Complete Prolapse. A Report of 206 Cases.**

By C. A. GORDON. *Amer. J. Obstet. Gynec.*, 52, 228–236, August 1946. 41 refs.

Gordon discusses the Manchester operation with special reference to parturition and complete prolapse and reviews a number of cases. The necessity for shortening the transverse ligaments in operations for prolapse is now generally agreed, and the Manchester operation is based on this principle. Genital prolapse is a comprehensive term including many varieties of weakness, and it is clear that one operation will not cure all cases. For example, the Manchester operation will not cure enterocele and rectocele. His own experience of the Manchester operation makes it difficult to agree with the common view that this operation should not be used in patients likely to become pregnant or in cases of complete prolapse. Before 1932 many operations were employed in the U.S.A. for prolapse, but since that time the Manchester operation has become increasingly popular. In the 10-year period 1934–43, 236 operations for prolapse were carried out at St. Catherine's Hospital, Brooklyn, nearly all under local analgesia. The Manchester operation was used in 206 cases, vaginal hysterectomy in 21, Le Fort's operation in 2, and the interposition operation in 7 cases. Thirty-six of these patients were under 40 years of age and liable to become pregnant, and 10 patients had become pregnant. In 5 the course of pregnancy was unknown, and in the other 5 one was delivered with an episiotomy only, 3 with forceps, and 1 required Caesarean section for a rigid cervix.

A review of the literature shows that amputation of the cervix may cause abortion and rigidity of the cervix in labour, and is not a good operation for women in the reproductive period, whether by itself or as part of the Manchester operation. The combined operation shows a high incidence of recurrence after parturition. Results following parturition after the Manchester operation are reviewed, but it is not certain if in these cases the cervix was removed or not. The nature of delivery and recurrence appears to vary considerably with different writers. In the above series there were 89 cases of complete prolapse, and in the personal series of 26 cases there were no recurrences.

L. W. Lauste

85. **The Sterilization of Females at Auschwitz Concentration Camp.** (La stérilisation féminine au camp d'Auschwitz.)

By P. FUNCK-BRENTANO. *Méd. français, Paris*, 6, 257, September 10–25, 1946.

The author's interest in this subject was roused by the examination at his clinic of a young Polish woman who had been submitted to an intra-uterine injection of a caustic substance at Auschwitz Concentration Camp. A former pupil who was interned there for 2½ years gave him further details, and he also summarizes facts given by a Russian Commission which had deportee doctors at Auschwitz as members. These included Dr. Limousin, a professor of the medical faculty of Clermont-Ferrand. One block of the camp hospital was reserved for experiments on women. The experiments included the testing of various substances for contrast media for radiography of the genital organs, methods of sterilization, and studies on the ovaries removed following radiological sterilization. Prof. Glauber of Breslau was the surgeon in charge. It is clear that hundreds of cases were dealt with. The patient examined by the author had had an intra-uterine injection of some caustic followed by much pain and pyrexia. When examined the cavity of the uterus was found to be small, the left tube was occluded at the uterine end and the right one was blocked a short distance along. Such experiments were possibly made to provide methods of extinguishing populations deemed unsuitable by the Reich and also to test endocrine preparations.

R. K. Bowes

Urology.

86. **Prostatism in Women.**

By S. R. HOOVER. *Urol. cutan. Rev.*, 50, 326–328, June 1946. 2 refs.

The title of this paper, as the author points out, is somewhat misleading. He reviews 45 cases in women whose chief complaint was frequency and urgency of micturition, associated with pain and burning and occasionally haematuria; there was also, in 1 or two cases, difficulty in emptying the bladder. All these complaints were aggravated

when the patient was standing, and a limited degree of relief was obtained on lying down. Nocturia was seldom reported, and apart from occasional pus cells and commonly alkaline urine, nothing abnormal was found on analysis of the urine; in fact, in general, the urine was clear and sparkling.

On cystoscopy the mucosa of the posterior urethra presented a " moth-eaten " appearance in the first 1 cm., and there were 1 to 3 longitudinal fissures extending over the vesical neck to the bladder mucosa. Between these fissures were sharp elevations, tending to bleed from their summits. Just inside the internal urethral orifice of the bladder the mucosa was hypertrophied sufficiently to form a definite ridge or bar across the posterior aspect of the orifice. He considers that the symptoms were due to this ridge or bar. Stricture of the urethra was not encountered in any case. The normal angle formed by the bladder and urethra was frequently altered by 45 to 90 degrees, the internal orifice being anterior to the external orifice with the patient in the upright position. The residual urine varied from 0 to 15 ml.

All cases were treated by electro-coagulation of the mucosa of the posterior urethra with removal of the elevated bladder mucosa, when necessary, with the cutting current. The urethral mucosa was destroyed down to the connective tissue, care being taken not to damage the sphincter. Using a 24 French McCarthy electrome, three or four small pieces were removed from the vesical neck. The microscopic report on these sections is summarized as follows: thickening of the mucosa; oedema; varicosity of the blood vessels; lymphocytic infiltration; fibrosis.

The author states that the degree of relief has varied from immediate and complete to delayed and partial, but in no case did the patient feel that the operation had not been worth while.

[It is significant that all the 45 cases reported were of private patients, and no glandular structure was found in the tissue removed.]

A. W. Badenoch

See also No. 3.